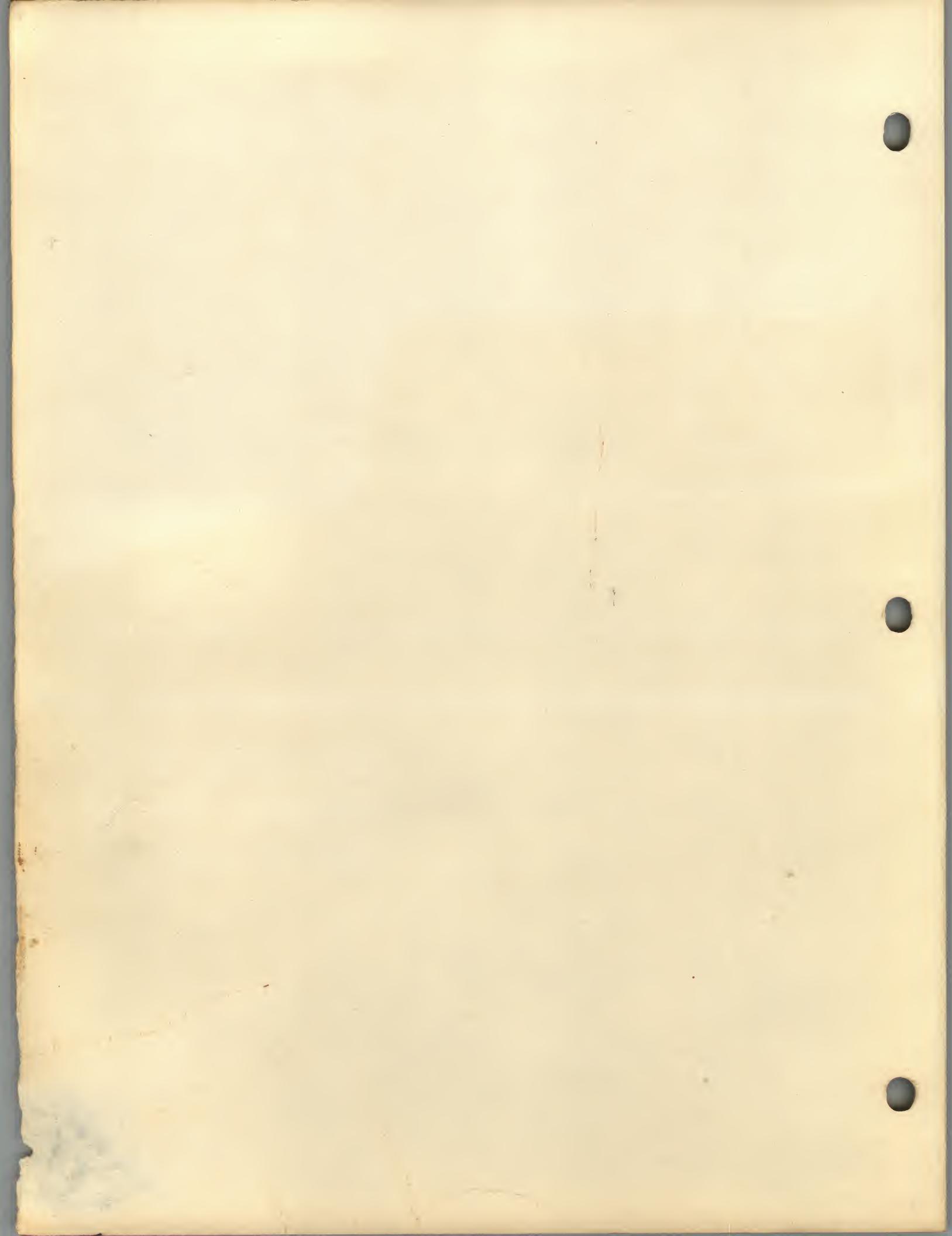


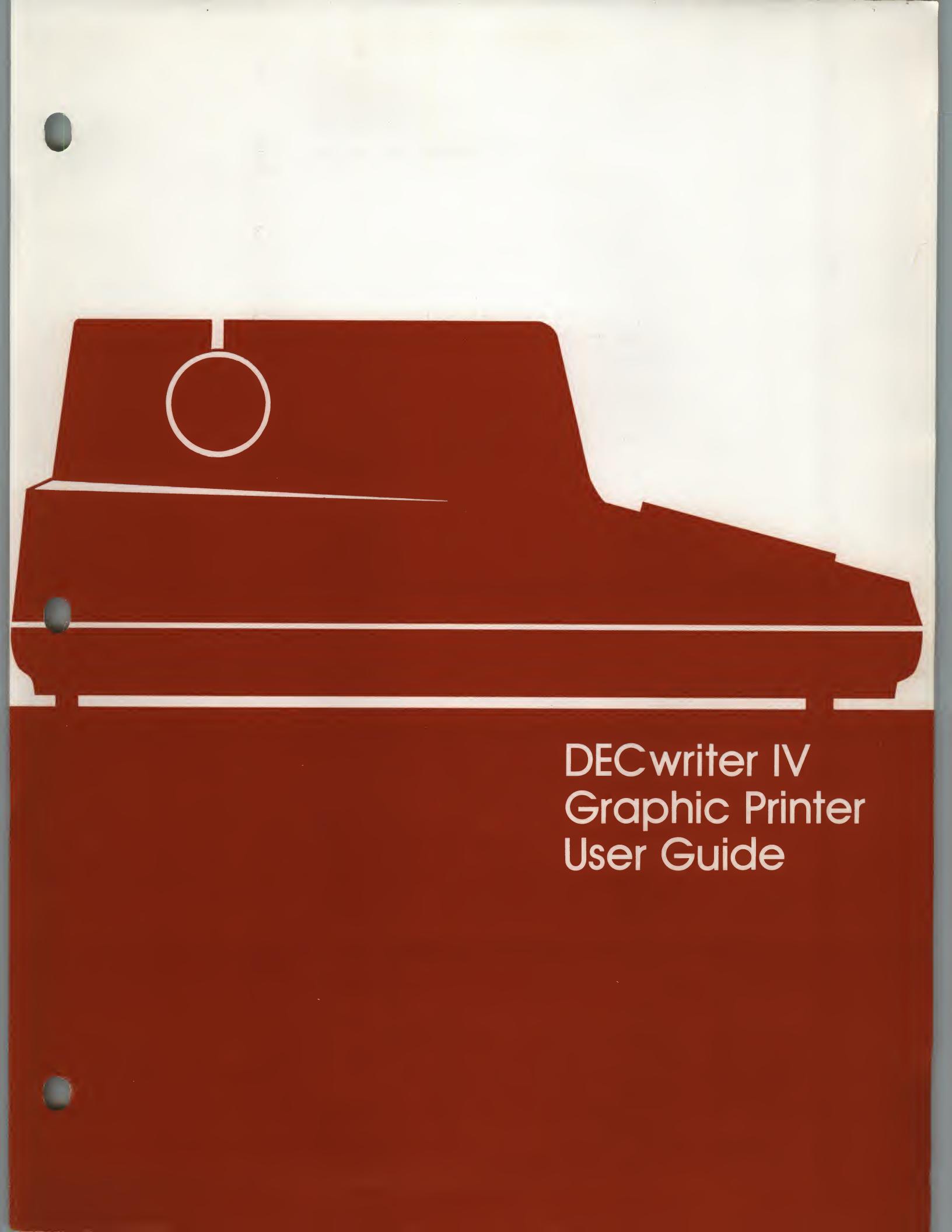
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DECwriter IV Graphic Printer

User Guide

digital



A photograph of a DECwriter IV Graphic Printer, a large red printer with a paper output bin extending to the right. It features a circular hole punch on the front panel and two circular holes on the left side for paper alignment. The printer is set against a plain white background.

DECwriter IV Graphic Printer User Guide

First Edition, January 1981

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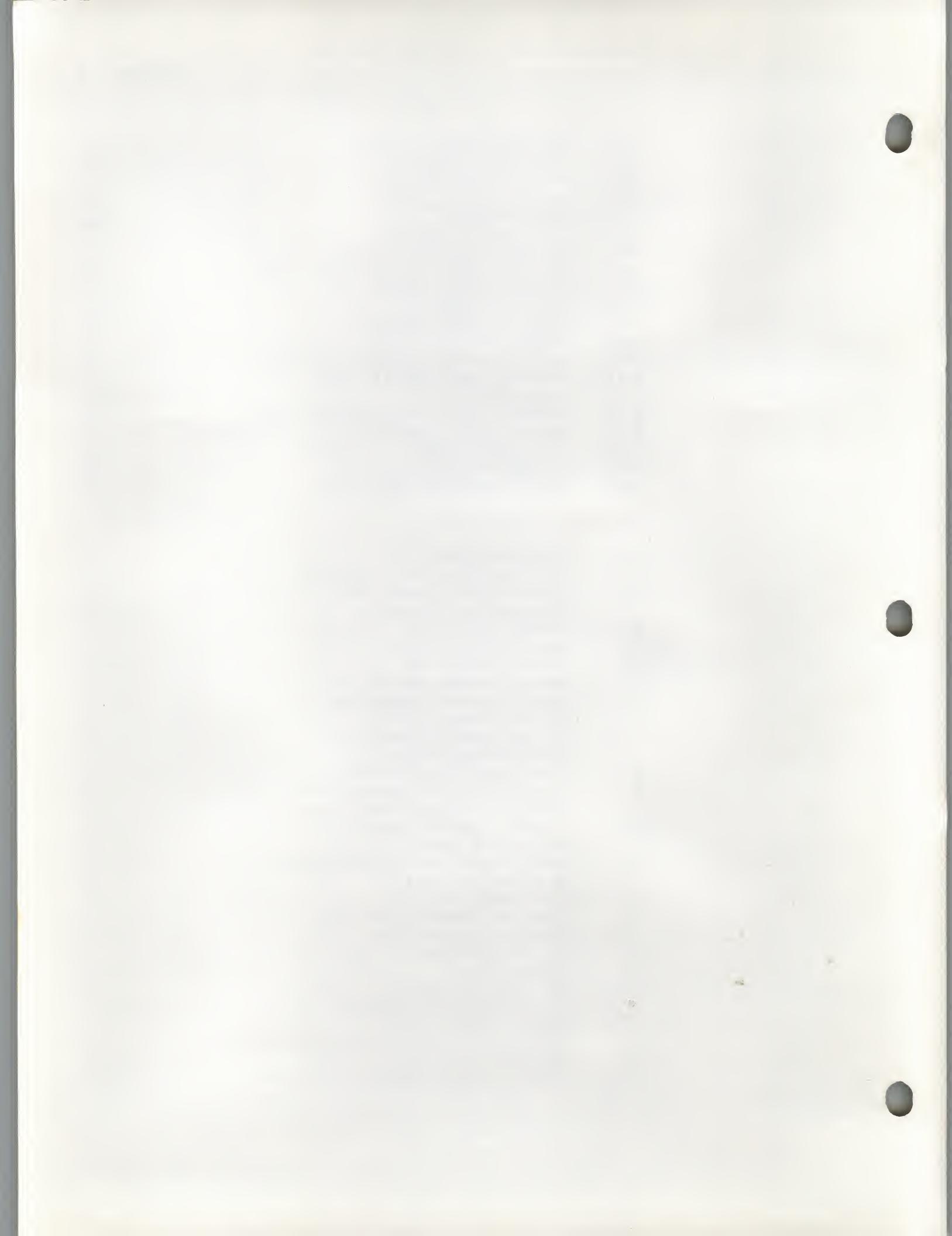
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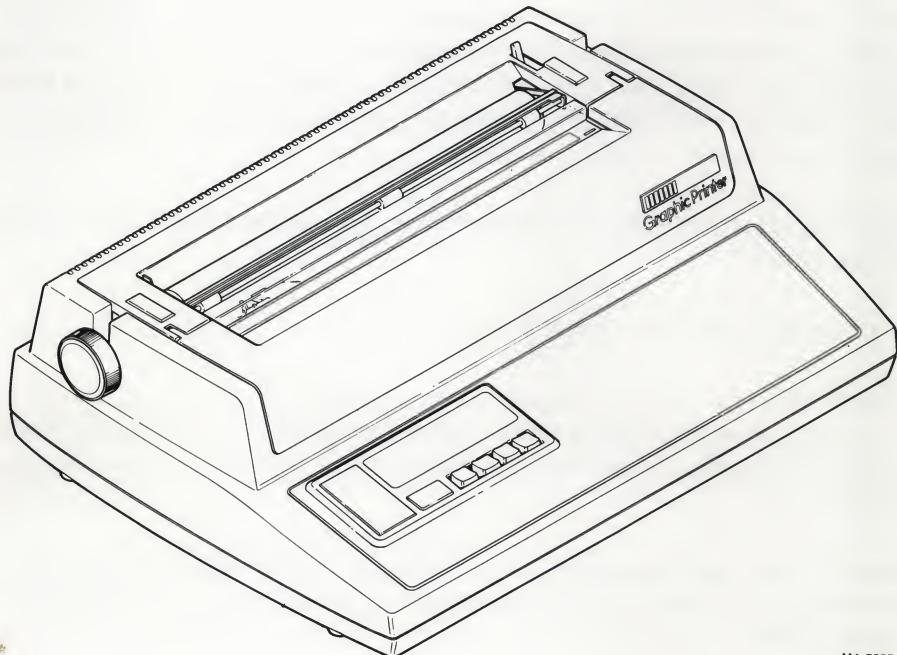


INTRODUCTION

DECwriter IV Graphic Printer

DECwriter IV Graphic Printers are receive-only (RO) microprocessor-controlled, low-cost, desk-top printers. They use an impact dot matrix printing technique for character representation. DECwriter IV Graphic Printers operate in one of two printing modes, text or graphic. In text mode, characters are printed as they are received. In graphic mode, received characters define columns of printed dots.

The printer can be used as an output device for a computer or word processor so that characters received from the computer are printed. The graphic printer can also be used as the output device for a graphic terminal such as GIGI (Graphics Image Generator and Interpreter).



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DECwriter IV Graphic Printers can communicate directly with a computer at speeds up to 9600 bits-per-second. They can also communicate with computers over a communication line through a full duplex modem or acoustic coupler at speeds up to 1200 bits-per-second. The following DECwriter IV Graphic Printer models are available.

LA34-RA	Basic Printer (no options or supplies included)
LA34-VA	Graphic output (roll paper holder, paper low detector option, BC22A-25 cable, ribbon cartridge, and roll of paper included)
LA34-WA	Printer output (tractors, paper out detector option, BC22A-25 cable, ribbon cartridge, and tractor feed paper sample included)

NOTE: All three models have graphic capabilities.

DECwriter IV Graphic Printer User Guide

This User Guide covers all three graphic printer models. Basically, this book describes terminal installation, operation, preparation, and character processing.

The chapters are organized by function. This allows you to reference the specific chapter that covers the function you want to perform. The chapters are also arranged according to how frequently they are used. For example, the frequently used Operating Information chapter is near the front of the book. However, installation is usually performed once. Therefore, the Installation chapter is near the back.

Color is used in this book to highlight tables, procedures, and specific areas within a figure.

The book is divided into the following chapters.

Chapter 1 Operating Information – provides a general introduction to the DECwriter IV Graphic Printer operation and shows all terminal controls and indicators. Specific operating information may depend on the computer software.

Chapter 2 Printer Preparation – describes procedures to change ribbon cartridges, install paper or preprinted forms, adjust the print head, and set the top of form.

Chapter 3 Text Mode Character Processing – describes the terminal response to received characters while operating in text mode. The chapter provides a description of the printable characters and control functions processed by the printer.

Chapter 4 Graphic Mode Character Processing – describes the graphic printer's response to received characters while operating in graphic mode. This chapter includes a description of graphic mode and the procedure used to enter and exit graphic mode.

Chapter 5 Communication – describes DECwriter IV Graphic Printer EIA and 20 mA interfaces, communication features and methods of controlling data received by the printer to prevent an input buffer overflow.

Chapter 6 Installation – describes environmental conditions to consider before installing the terminal. A detailed unpacking and installation procedure is provided. The chapter provides a step-by-step procedure used to turn on the graphic printer and verify operation.

Chapter 7 Testing and Troubleshooting – describes the self tests and status message. This chapter also includes a list of checks a user should make before requesting service. A maintenance section provides general cleaning and care recommendations.

Chapter 8 Options – describes the DECwriter IV options. This chapter describes option installation and operating information if the option can be installed by the customer.

Chapter 9 Accessories and Supplies – describes accessories and supplies offered for the DECwriter IV Graphic Printer. This chapter includes a short description of each accessory and supply, part number, and ordering information.

Appendix A – provides detailed graphic printer specifications.

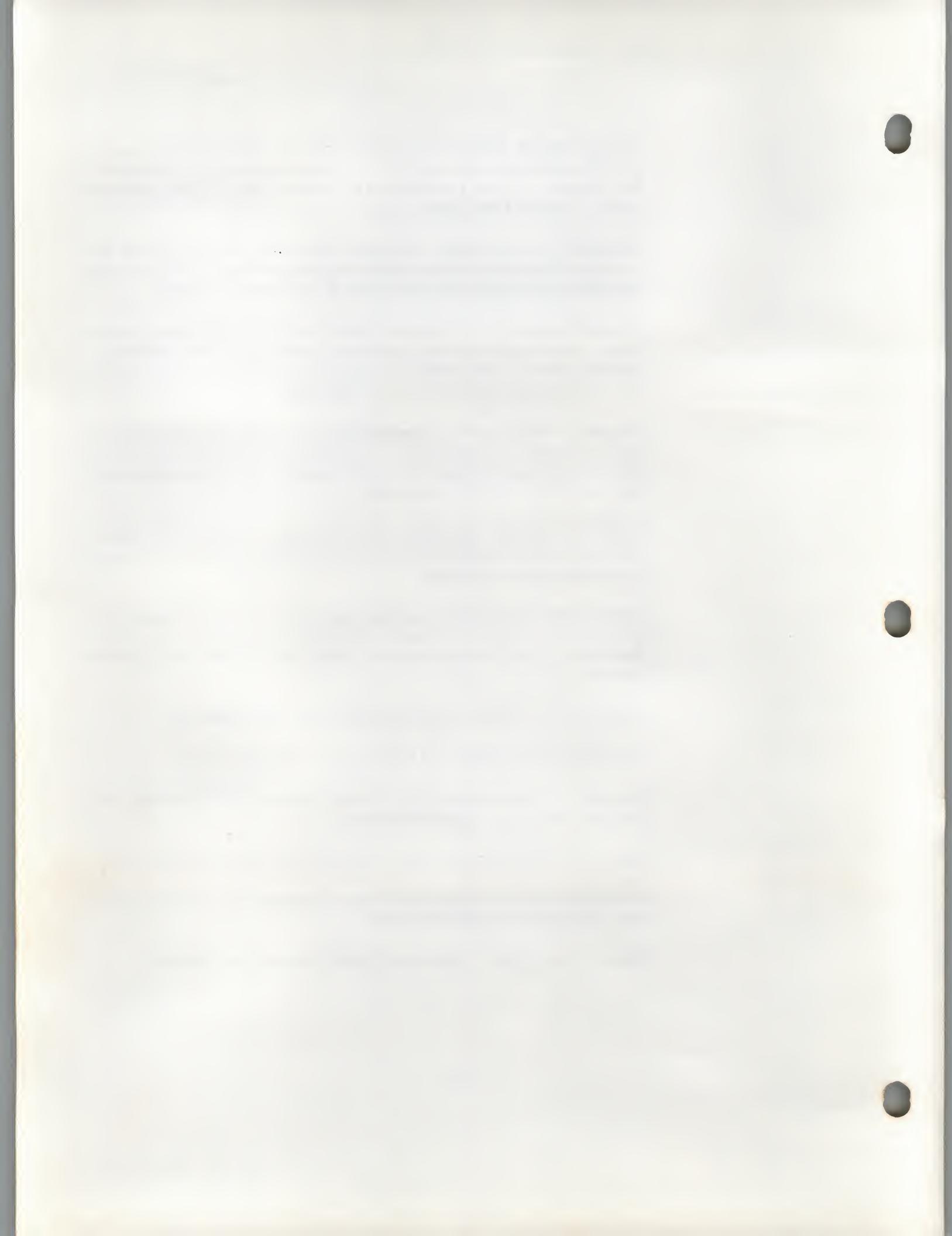
Appendix B – is a summary of the text mode control functions.

Appendix C – is a summary of the graphic mode printable characters, and the ANSI and private control characters.

Appendix D – lists and describes other terminals offered by DIGITAL.

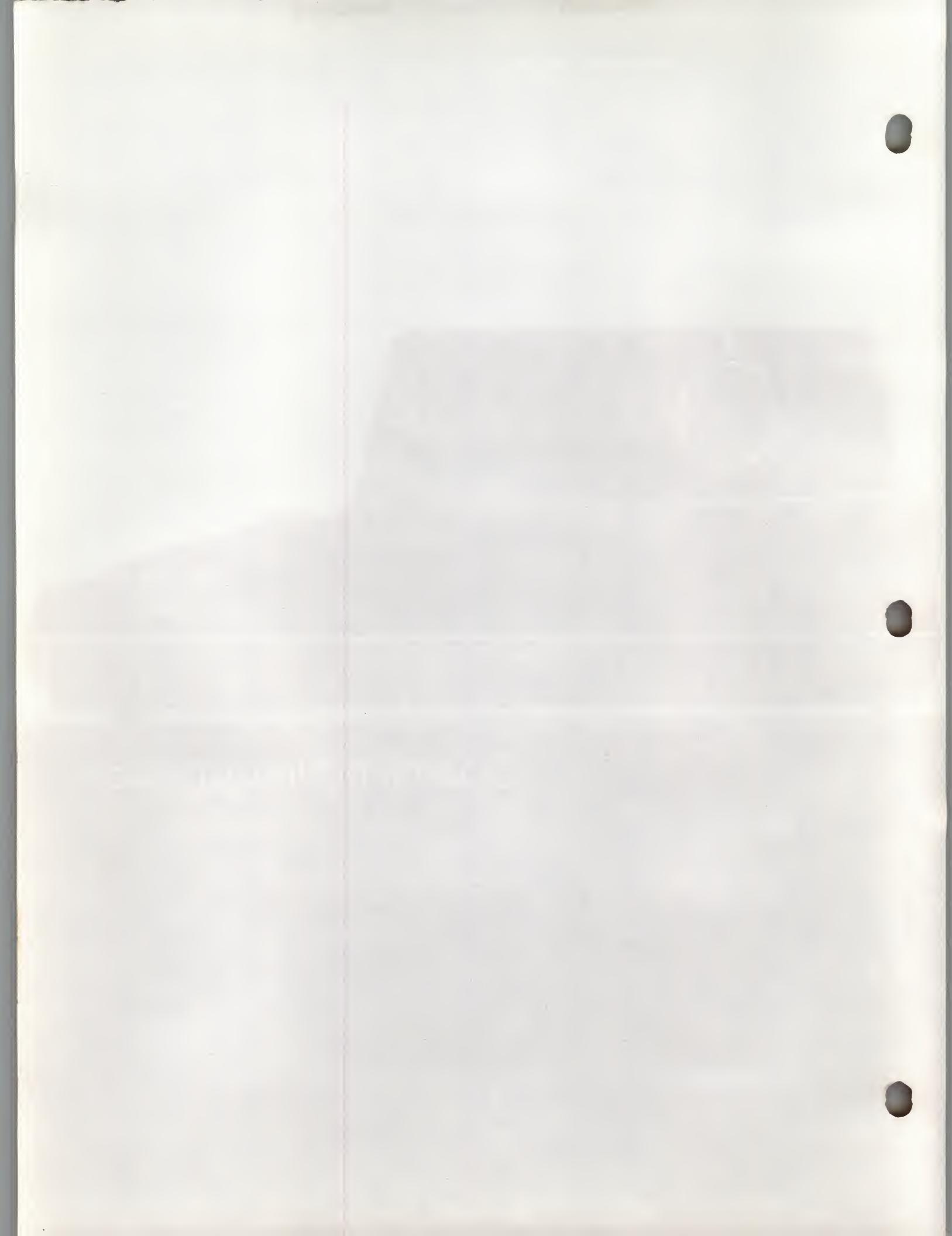
Index – lists important items in alphabetical order, and page numbers where they may be found in this user guide.

Warranty Information – describes DIGITAL warranty and services



A graphic of a red folder or binder is positioned at the top of the page. It has a central circular hole punch and two vertical slots on the left side. The folder is tilted slightly to the right.

Operating Information



OPERATING INFORMATION

GENERAL

This chapter includes a general overview of the DECwriter IV Graphic Printer operation, and a description of each control and indicator. Detailed operating information may depend on the computer software.

PRINTER OPERATION

The DECwriter IV Graphic Printer operates on-line, off line or local. While on-line the graphic printer can receive, process, and print data from a computer or remote device (Figure 1-1). When the printer is on-line, the only operator control panel key that is active, is the CLEAR FAULT key.

NOTE: The CLEAR FAULT key can be used regardless of the on-line/off-line setting. (Refer to the CLEAR FAULT key description in this chapter for more detail.)

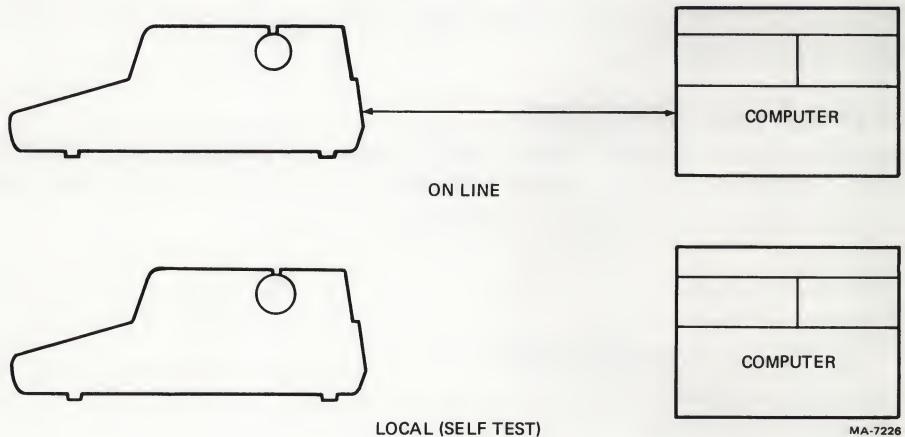


Figure 1-1 Printer Operation

To switch to off-line, press and lock the ON LINE/OFF key in the OFF (down) position. The graphic printer then sends the computer a request to temporarily stop sending data. While off-line, the graphic printer continues to receive and store data. The FORM FEED, SET TOF, and SELF TEST keys are active and can be used. This allows the operator to set a new top of form, or change a communication feature, without disconnecting from the communication line. To return on-line, press the ON

LINE/OFF key again to release the locking key. The graphic printer then sends the computer a request to resume sending data.

NOTE: The XON/XOFF feature must be on and the computer must respond to the stop and resume requests. If not, data may be lost when the printer is switched off-line. The XON/XOFF feature is described in the Communication chapter.

If the SELF TEST key is pressed while off-line, the graphic printer switches to a local condition (Figure 1-1). The printer performs the following functions.

- Disconnects from the communication line
- Exits graphic mode (if selected)
- Clears the input buffer (the input buffer stores characters to be printed)
- Prints a status message (the status message is a list of the currently selected features)

After pressing the SELF TEST key, the operator can select the self test.

NOTE: After the SELF TEST key is pressed, any data sent to the graphic printer is lost. If a modem is being used, communication with the computer must be restored.

CONTROLS AND INDICATORS

The DECwriter IV Graphic Printer has a number of controls and indicators used by the operator to control and monitor printer operation. The controls and indicators section is organized as follows.

- Printer Controls
- Operator Control Panel
- Data Communication Switches
- Visual Indicators
- Audible Indicators

Printer Controls

The following paragraphs describe the function of the printer controls.

Voltage Selector Switch – The voltage selector switch (Figure 1-2) changes the printer to match the available ac input voltage range. The DECwriter IV Graphic Printer can operate at 120 Vac or 230 Vac (refer to the Installation chapter for more detail).

CAUTION: If the voltage selector switch is not set at 230 Vac when operating the DECwriter IV with a 180-256 Vac power source damage to the DECwriter IV power supply may result.

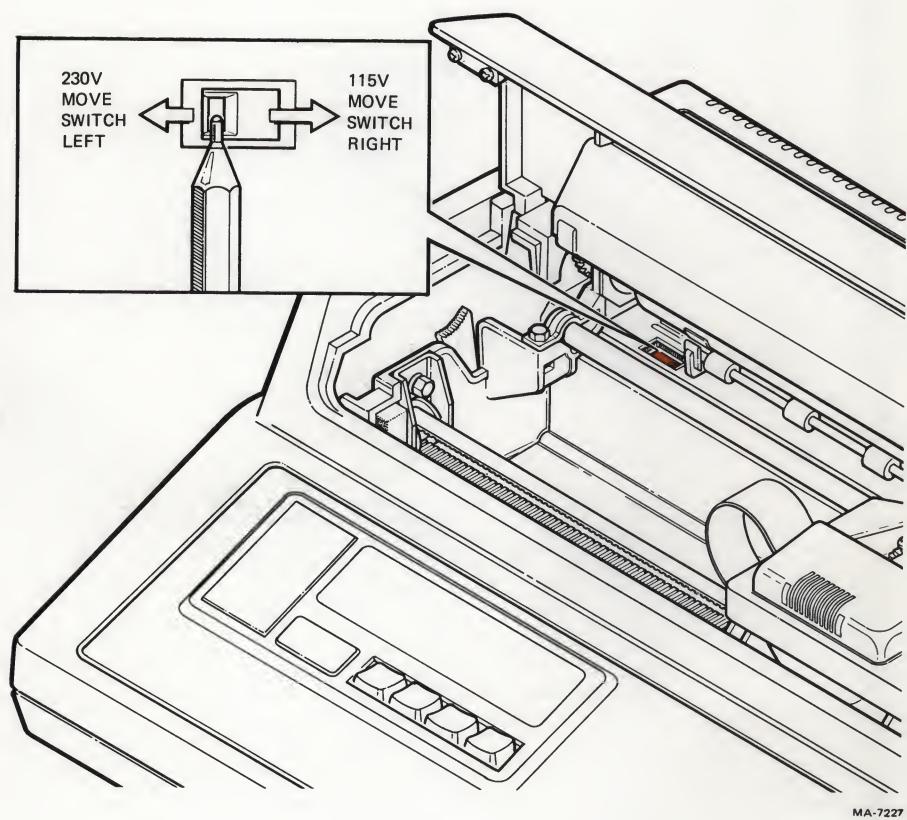


Figure 1-2 Voltage Selector Switch

Always use a ball point pen or equivalent, to select the voltage. Never use a lead pencil.

Power ON/OFF Switch – The power ON/OFF switch turns power to the graphic printer on or off (Figure 1-3).

NOTE: Read the step-by-step power on procedure in the Installation Information chapter before using this switch.

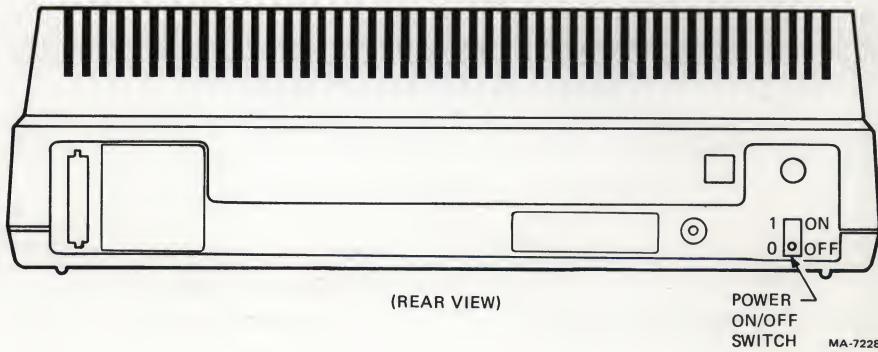
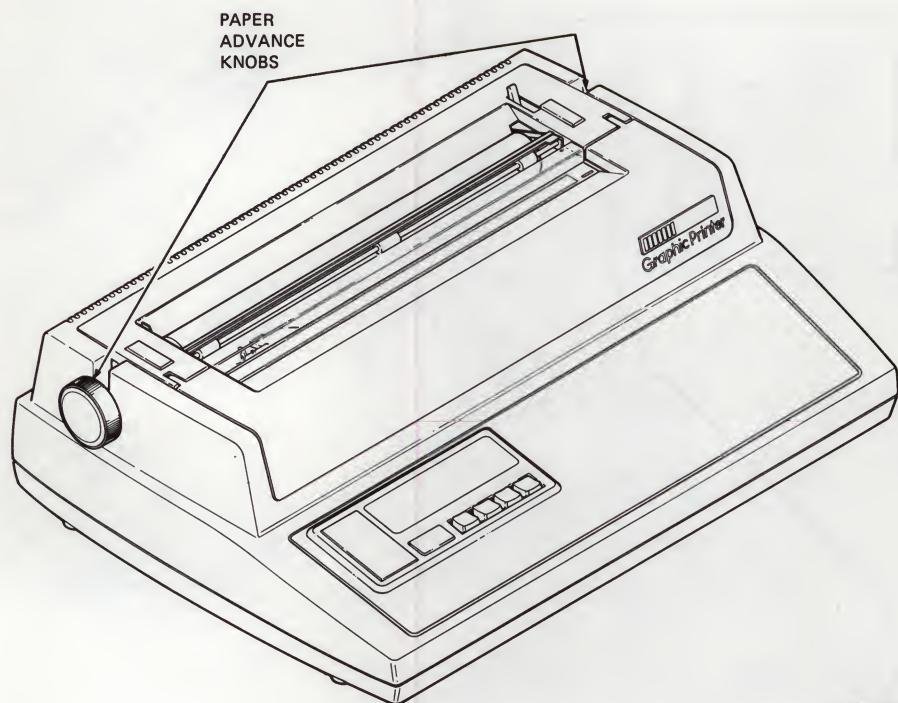


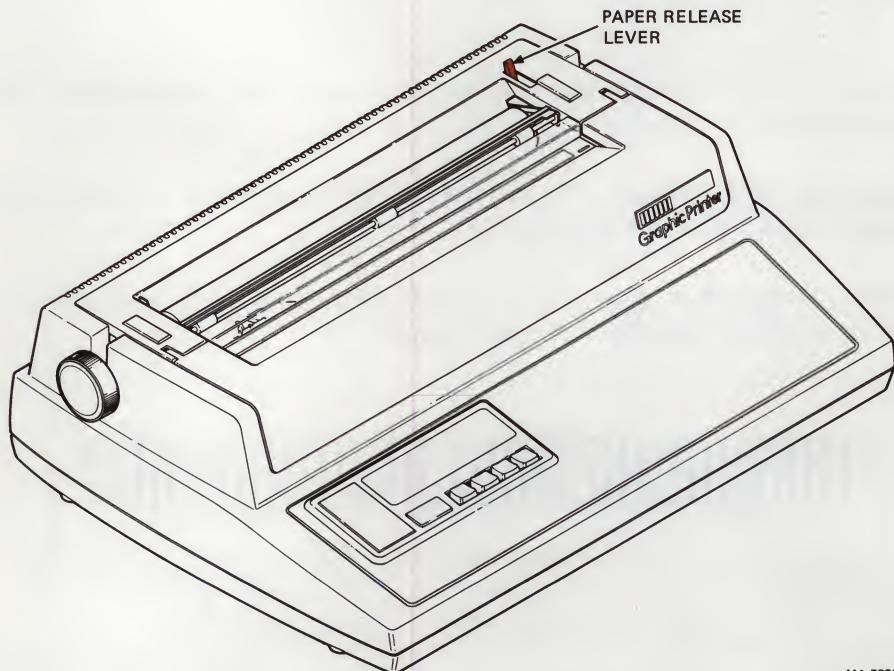
Figure 1-3 Power ON/OFF Switch

4 OPERATING INFORMATION



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Figure 1-4 Paper Adavance Knobs



MA-7230

Figure 1-5 Paper Release Lever

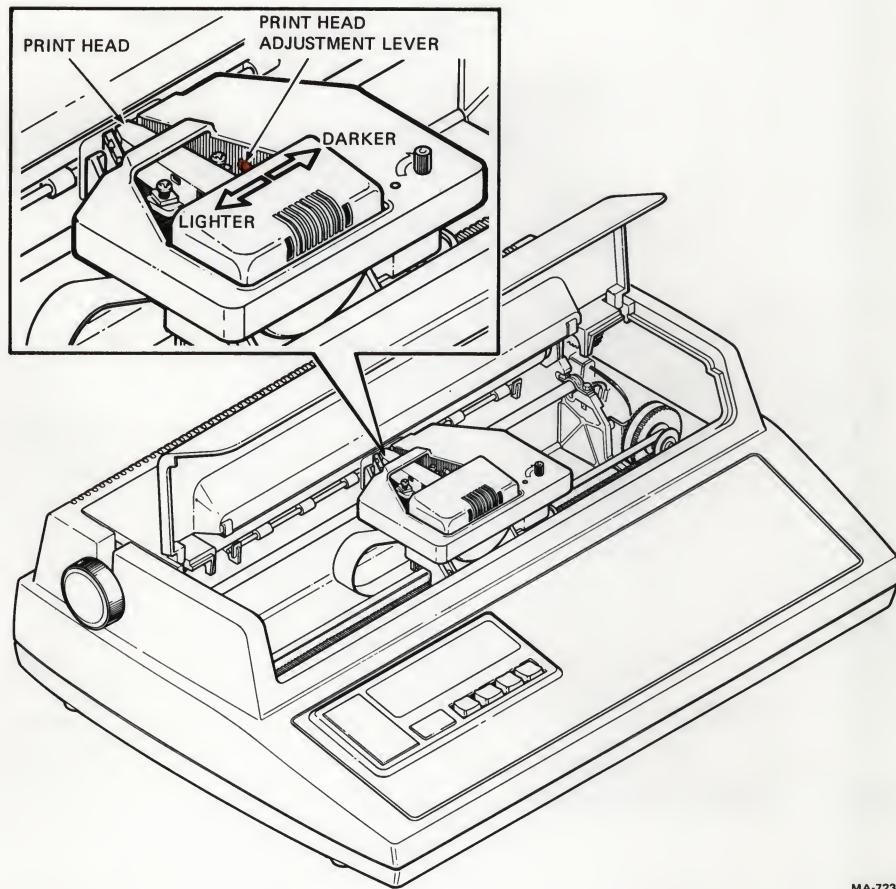


Figure 1-6 Printhead Adjustment Lever

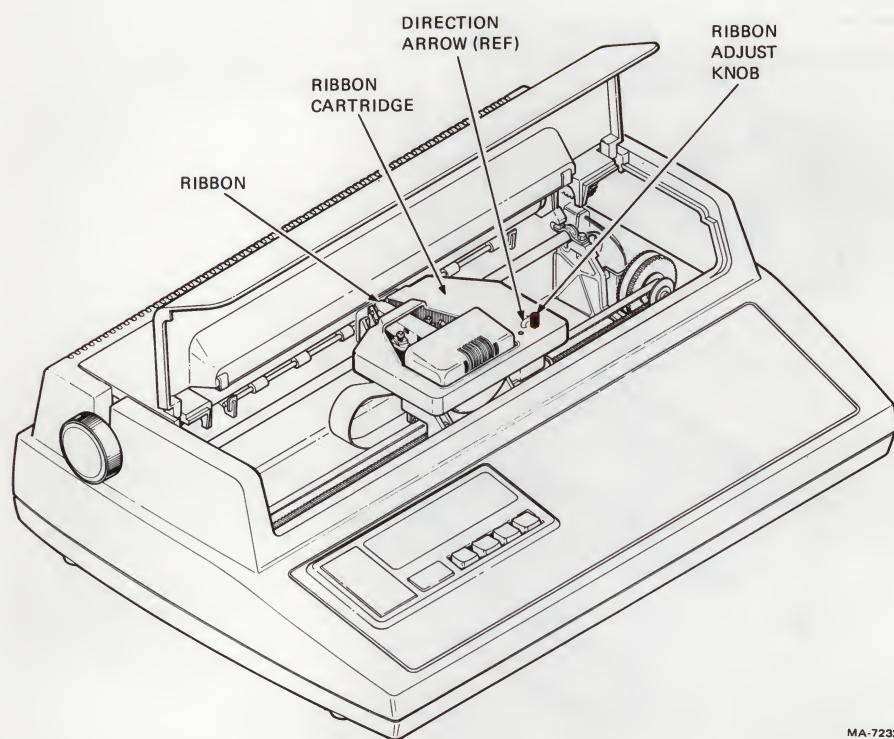
Paper Advance Knob – The paper advance knob advances paper 1/12 of an inch at a time (Figure 1-4). Press the right paper advance knob in, and turn it to roll the paper in either direction. This allows precise vertical paper positioning.

NOTE: Moving the paper advance knob changes the top of form reference.

Paper Release Lever – The paper release lever (Figure 1-5) is used to reposition or remove paper from the printer.

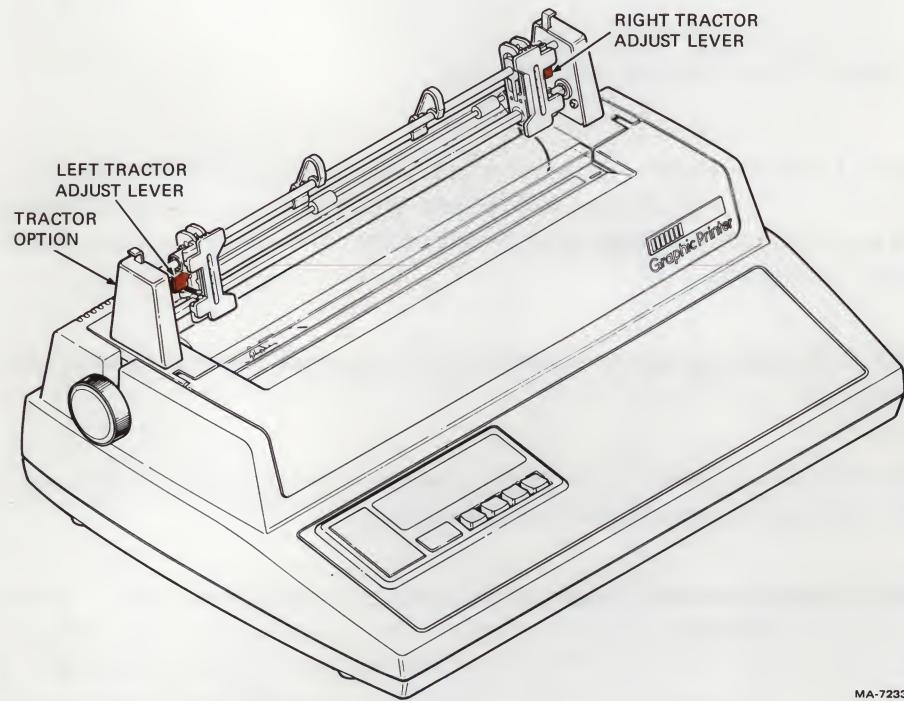
Printhead Adjustment Lever – The printhead adjustment lever controls the space between the printhead and the platen. Use the printhead adjustment lever to adjust the printhead for clear printing on single or multipart forms (Figure 1-6). Refer to the Printer Preparation chapter for the printhead adjustment.

6 OPERATING INFORMATION



MA-7232

Figure 1-7 Ribbon Adjust Knob



MA-7233

Figure 1-8 Tractor Adjust Levers

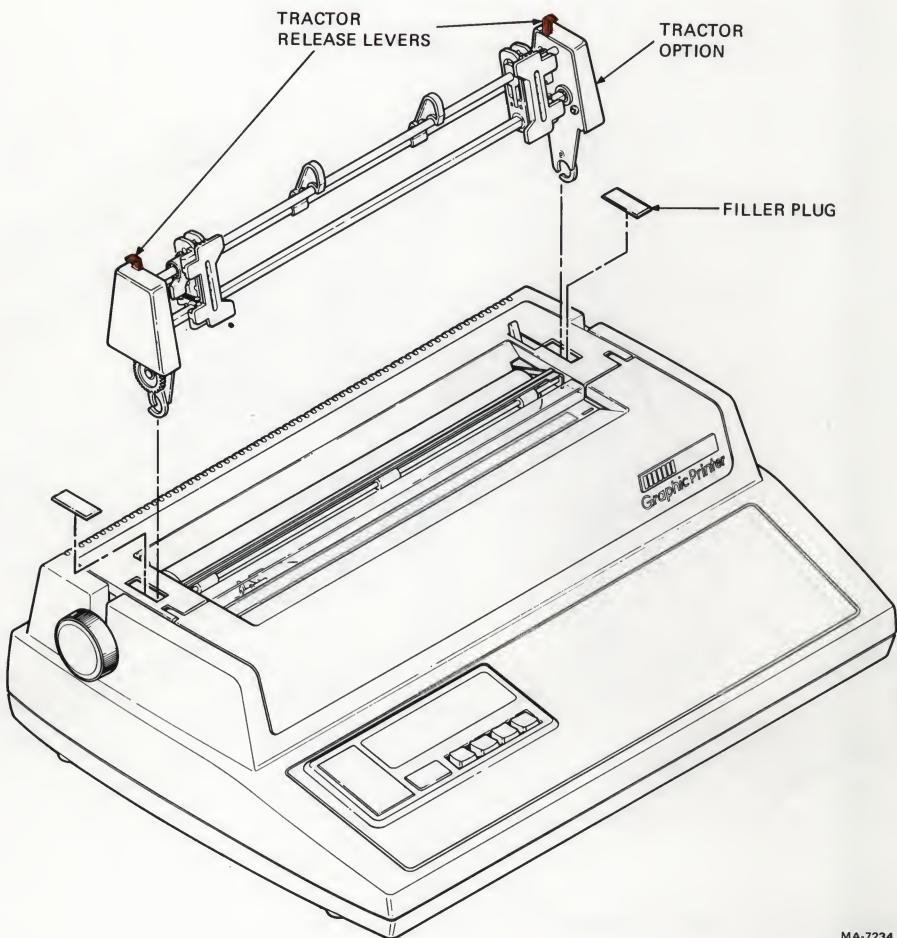


Figure 1-9 Tractor Release Lever

Ribbon Adjust Knob – The ribbon adjust knob is used to tighten the ribbon when installing a new ribbon cartridge (Figure 1-7). Refer to the Printer Preparation chapter for the ribbon cartridge installation procedure.

Tractor Adjust Levers (Part of the LAX34-AL Tractor Option) – The tractors can be moved horizontally to accommodate different size paper. The tractor release levers (Figure 1-8) are used to clamp the tractors in place. Pull the tractor release lever toward the front of the printer to move the tractor. Push the tractor release lever toward the back of the printer to lock the tractor in place. Refer to the Printer Preparation chapter for the correct tractor adjustment procedure.

Tractor Release Levers (Part of the LAX34-AL Tractor Option) – The tractor release levers are used to install or remove the LAX34-AL Tractor Option (Figure 1-9). Refer to the Options chapter for the tractor option installation procedure.

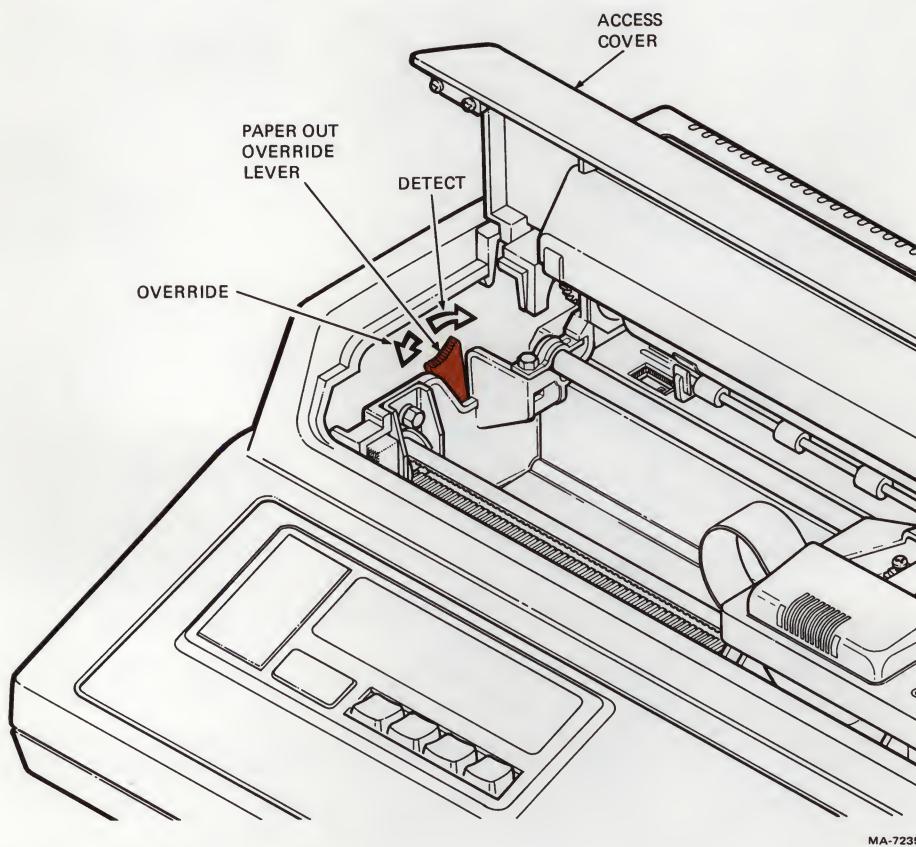


Figure 1-10 Paper Out Override Lever

Paper Out Override Lever (Part of the LAX34-PL Paper Out Option)—The paper out override lever is used to disable paper out detection. This is useful when using single-sheet paper or forms (Figure 1-10).

Operator Control Panel

The operator control panel (Figure 1-11) provides easy access to the keys that control daily printer operation. The following paragraphs describe each key's function.



ON-LINE (up position) – In this position, the graphic printer is capable of receiving and processing data. The FORM FEED, SET TOF, and SELF TEST keys are not active.

NOTE: *The CLEAR FAULT key can be used regardless of the on-line off-line setting.*

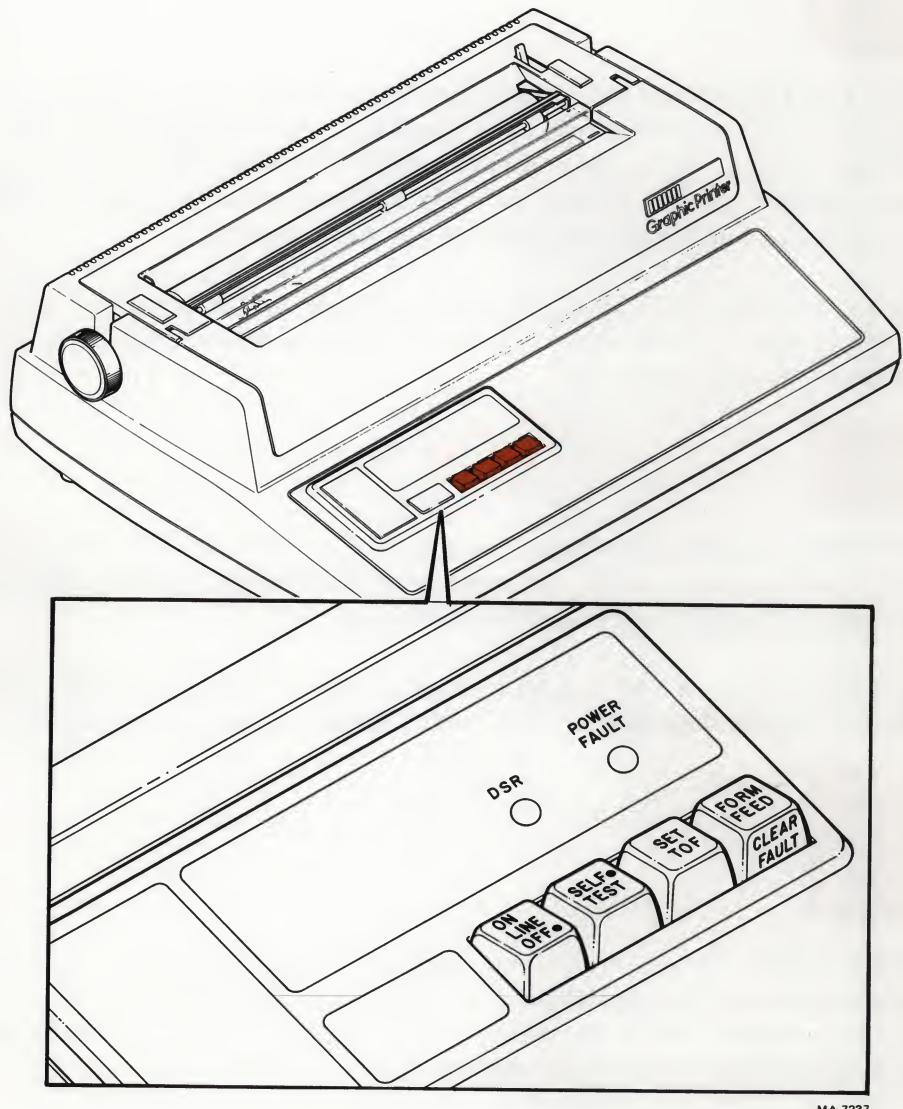


Figure 1-11 Operator Control Panel

OFF • (down position) – In this position, the graphic printer sends the computer a request to temporarily stop sending data. The FORM FEED, SET TOF, and SELF TEST keys are active and may be used.

NOTE: If the graphic printer is switched off-line data can be lost unless, the XON/XOFF feature is selected and the computer responds to the XOFF and XON control characters. Refer to the Communication chapter for more detail on XON/XOFF.

**SELF •
TEST**

SELF TEST • – When the graphic printer is off-line, this key is used to print the status message and select self test. Pressing the SELF TEST key disconnects the printer from the communication line, causes the printer to exit graphic mode, and clears the input buffer (Refer to the Testing and Troubleshooting chapter for more detail.)

NOTE: After the SELF TEST key is pressed, any data sent to the graphic printer is lost. If a modem is being used, communication with the computer must be restored.

**SET
TOF**

SET TOF (top of form) – When the graphic printer is off-line this key is used to define the current line as line one (top of form). This procedure is described in the Printer Preparation chapter.

During self test, this key is used to start the data loopback test. The data loopback test is described in the Testing and Troubleshooting chapter.

**FORM
FEED/
CLEAR
FAULT**

FORM FEED – When the graphic printer is off-line this key is used to advance the paper to top margin on the next page. During self test, this key is used to select one of the printer self tests. (Refer to the Testing and Troubleshooting chapter for more detail.)

NOTE: Do not confuse the top of form with top margin. Top of form is the physical top edge of the paper. Top margin is the line where you want printing to start.

CLEAR FAULT – After correcting any fault condition (paperout, printhead jam, or access cover open) press this key to resume printing.

Data Communication Switches

There is a set of data communication switches inside the DECwriter IV Graphic Printer (Figure 1-12) that allow the printer to operate with different computers or remote devices. Usually the switches are changed only when operating with a different computer. However, they should not be changed unless compatibility with that computer is verified. Read the Data Communication Switch section in the Communication chapter before using these switches. The following paragraphs include a short description of each switch.

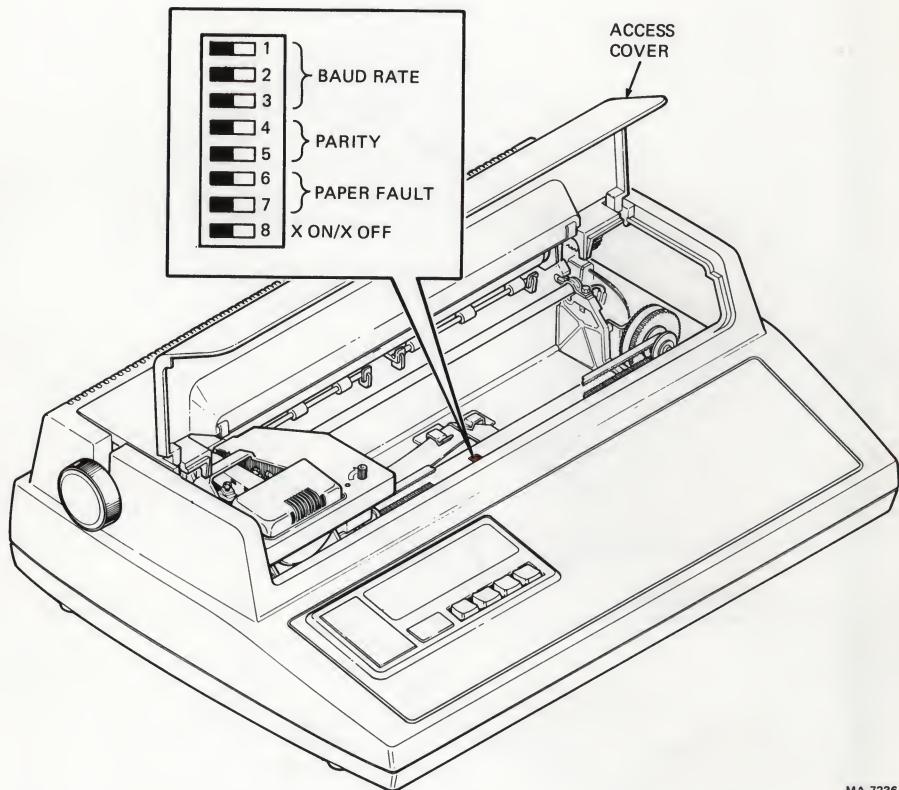


Figure 1-12 Data Communication Switches

Baud Rate (Speed) Switches 1,2 and 3 – These switches select the speed (bits-per-second) at which the graphic printer transmits and receives data.

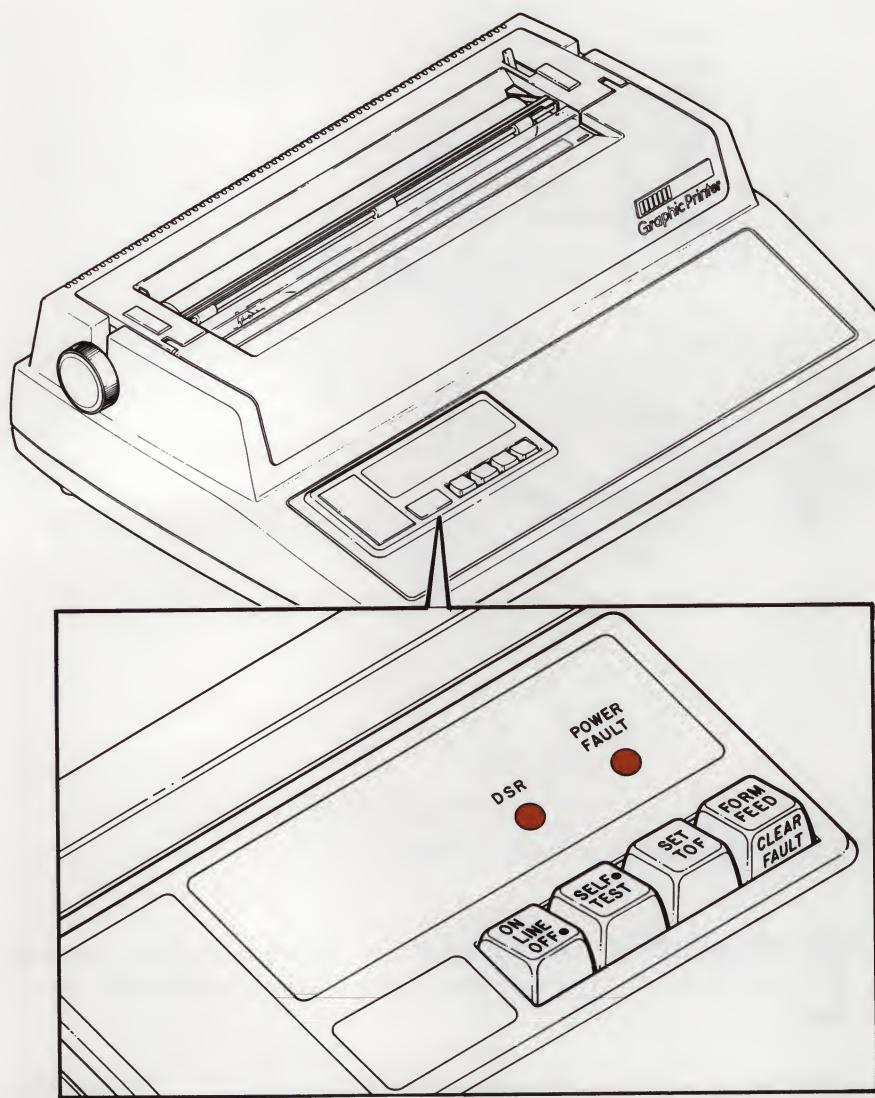
Parity Switches 4 and 5 – The parity feature is used to check the data transmitted between the computer and graphic printer. The parity switches select mark, space, even, or odd parity.

Paper Fault Switches 6 and 7 – These switches select the graphic printer response to a paper out or paper low condition if either the paper low detection option or paper out detection option is installed.

XON/XOFF Switch 8 – This switch turns the XON/XOFF feature on or off.

Visual Indicators

The following paragraphs describe the DECwriter IV Graphic Printer visual indicators in detail.



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Figure 1-13 Operator Control Panel Indicators

POWER/FAULT Indicator—This indicator (Figure 1-13) lights when power is turned on. When power is first turned on, the POWER/FAULT and DSR indicators show any errors during the power-up self test. Refer to the Testing and Troubleshooting chapter for more detail on the power-up self test. The POWER/FAULT indicator flashes when the printer is not ready to print for any of the following reason.

- Paper is out or low
- Access cover is open
- Print head is jammed (also indicated by multiple bell tones)

To correct any of these conditions refer to the Testing and Troubleshooting chapter.

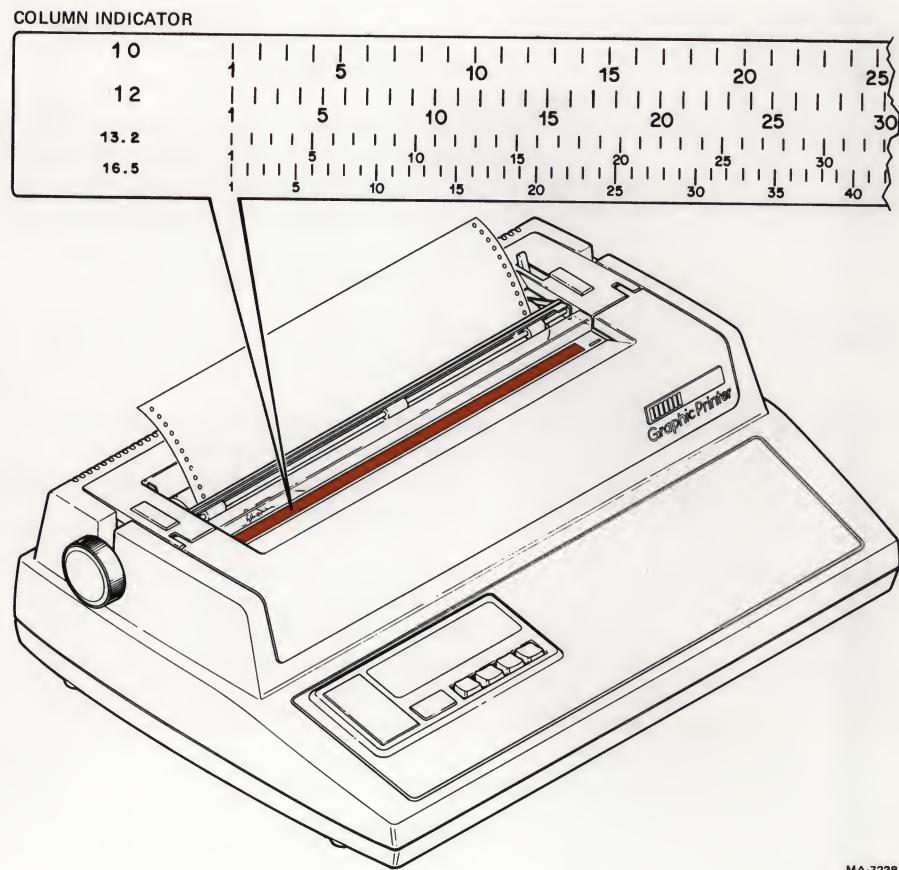


Figure 1-14 Column Indicator

DSR (Data Set Ready) Indicator—This indicator (Figure 1-13) lights when the graphic printer is ready to receive data. It is also used with the POWER/FAULT indicator to show any errors during the power-up self test. Refer to the Testing and Troubleshooting chapter for more detail on the power-up self test.

Column Indicator—The column indicator (Figure 1-14) shows the current position (column) of the printhead. Scales are provided for four of the horizontal pitch (characters per inch) selections.

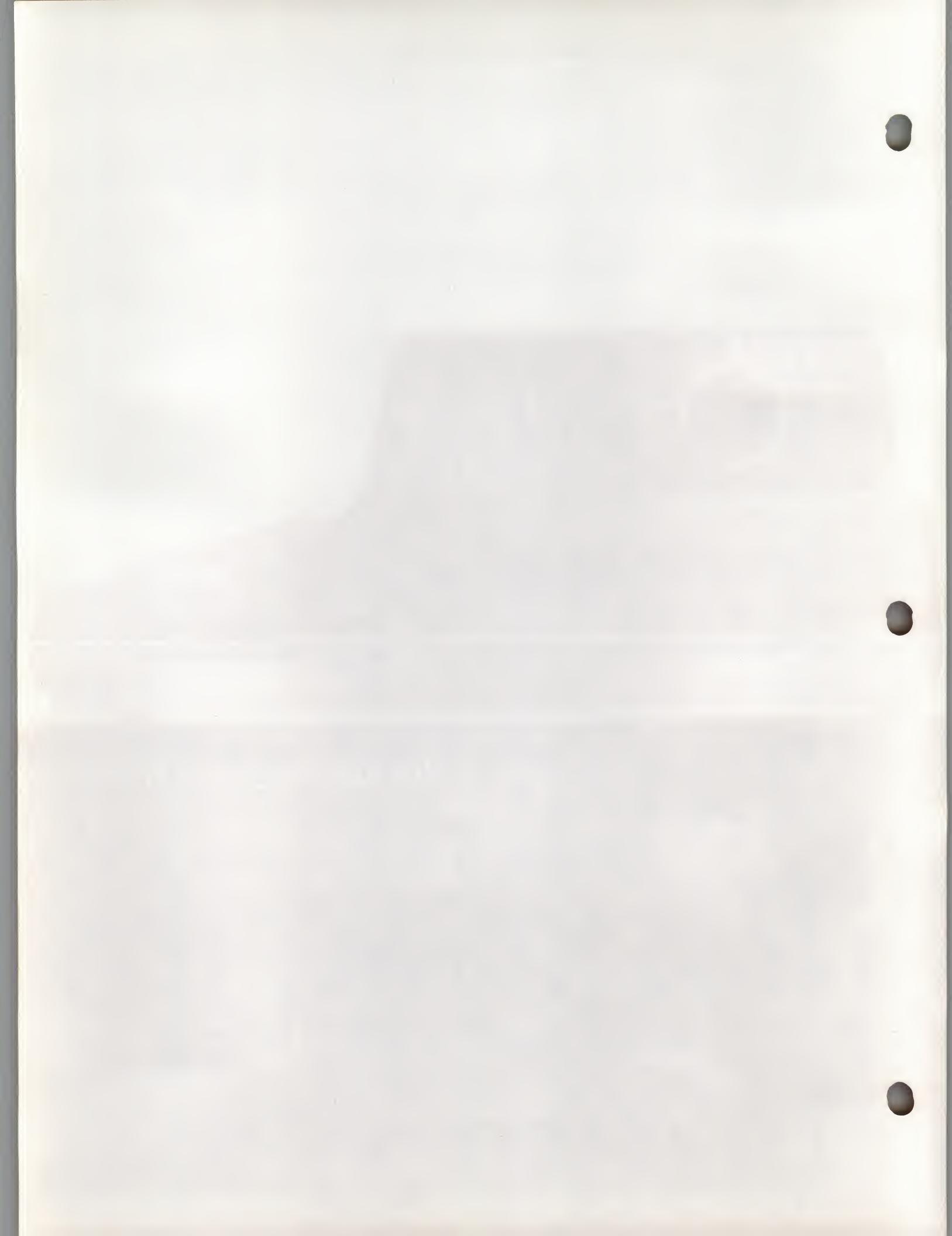
Audible Indicators

The conditions that cause a bell tone are listed in Table 1-1.

Table 1-1 Audible Indicators

Cause	Action/Comments
Input buffer overflow	If the DECwriter IV Graphic Printer is not capable of processing characters from the input buffer before the buffer fills, an input buffer overflow can occur. During an overflow condition, the bell tone sounds and the input buffer is cleared.
Bell code	Each bell code received by the graphic printer causes the bell tone to sound.
Printhead jam	Indicated by a flashing POWER/FAULT indicator and multiple bell tones. To correct the condition refer to the Testing and Troubleshooting Chapter.
Data loopback test	A bell tone sounds each time 126 characters are successfully transmitted. Refer to Testing and Troubleshooting chapter for more details on the data loopback test.

Printer Preparation



PRINTER PREPARATION

2

GENERAL

This chapter describes how to change ribbon cartridges, install paper or preprinted forms, adjust the print head, and set top of form.

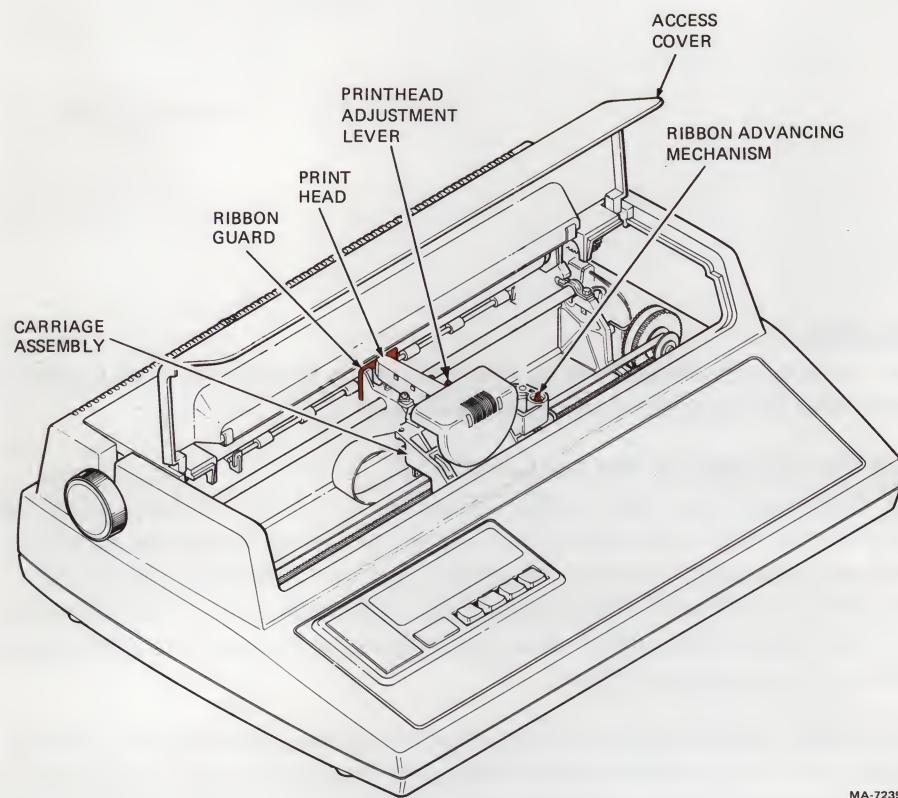
RIBBON CARTRIDGE INSTALLATION

The ribbon cartridge used in the DECwriter IV Graphic Printer usually provides twelve hours of continuous printing. Actual cartridge life depends on the type of printing done by the graphic printer. When the print density is too light, check the printhead adjustment (described later in this chapter). If the printhead is adjusted correctly and the print density is still too light, replace the ribbon cartridge.

CAUTION: Only ribbon cartridges recommended by DIGITAL (DEC P/N LA34R) or the equivalent should be used in the DECwriter IV Graphic Printer. Using other ribbon cartridges may damage the printhead and void the warranty. Refer to the Accessories and Supplies chapter for ordering information.

Perform the following procedure to install a ribbon cartridge. It is not necessary to turn the power off when installing a ribbon cartridge.

1. Open the access cover (Figure 2-1).
2. Remove (lift) and discard the old ribbon cartridge.
3. Move the printhead adjustment lever all the way to the left (Figure 2-1).
4. Turn the ribbon adjust knob on the new ribbon cartridge clockwise to tighten the ribbon (Figure 2-2).
5. Place the ribbon between the ribbon guard and the printhead (Figure 2-1).
6. Line up the snap buttons on the new ribbon cartridge with the mounting holes in the carriage assembly (Figure 2-2).
7. Slowly press the new ribbon cartridge onto the carriage assembly while turning the ribbon adjust knob. Verify that the slot in the ribbon cartridge (Figure 2-2) engages the tab on the ribbon advancing mechanism (Figure 2-1).



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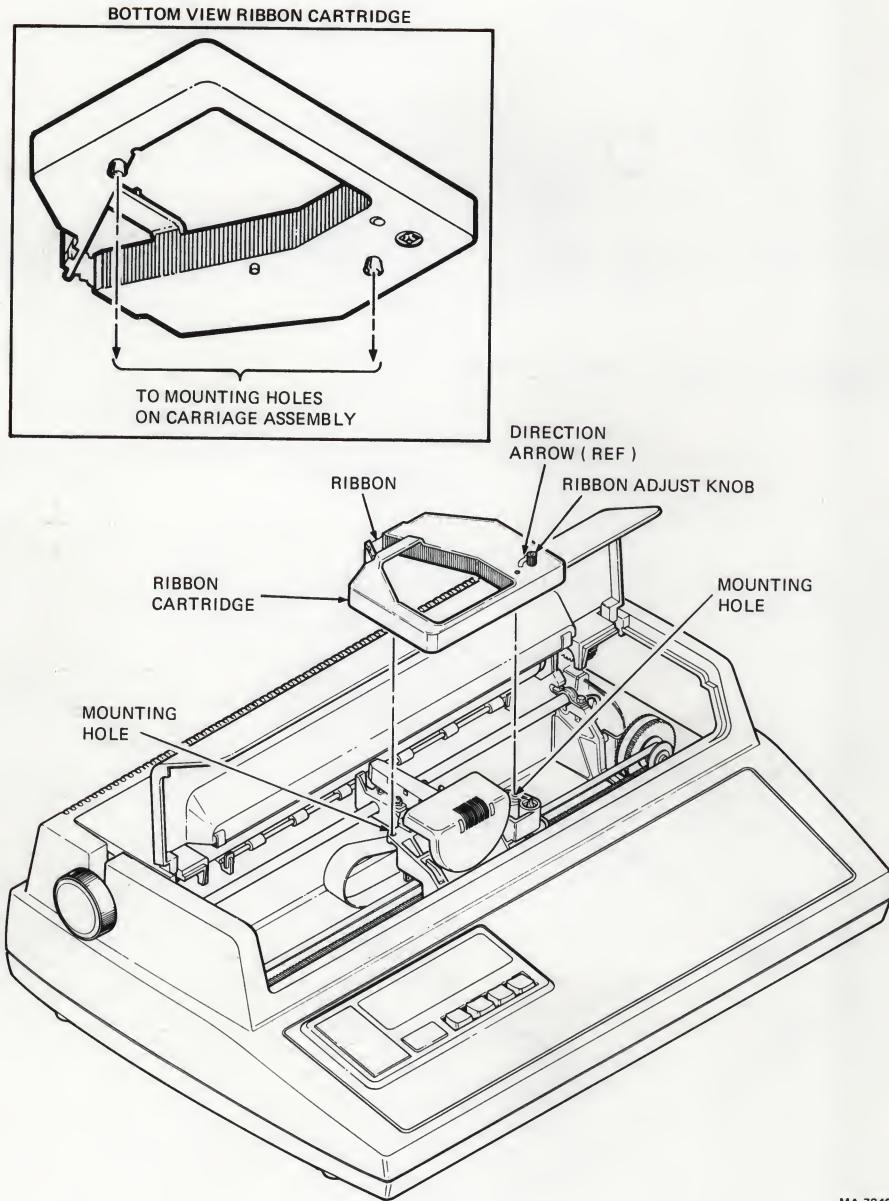
Figure 2-1 Carriage Assembly

8. While watching the ribbon adjust knob, manually move the printhead to the right and left two or three times. The ribbon adjust knob should turn in a clockwise direction when the printhead moves to the right. This means the ribbon is advancing correctly.
9. Close the access cover and press the CLEAR FAULT key.
10. Adjust the printhead as described later in this chapter.

LOADING PAPER AND PREPRINTED FORMS

The DECwriter IV Graphic Printer accepts friction feed or tractor feed paper ranging in width from 3 to 14 7/8 inches. Friction feed roll paper must be used to operate the printer as a graphics output printer. Refer to Appendix A for complete specifications. The following rules apply to paper used in the DECwriter IV Graphic Printer.

- Friction Feed Paper
 - Single sheet or roll paper can be used.
 - Preprinted forms are not recommended.
 - Multipart roll paper forms are not recommended.
 - Impact paper is not recommended.
 - Card stock is not recommended.



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Figure 2-2 Ribbon Cartridge

- **Tractor Feed Paper**

Multipart forms can have only four parts or three parts and one card part; the card must be the last part.

Dot or line glue margins are acceptable (one margin only).

First-surface impact paper is not recommended.

Split forms (different number of sheets on each side of the form) are not recommended.

Stapled forms are not recommended.

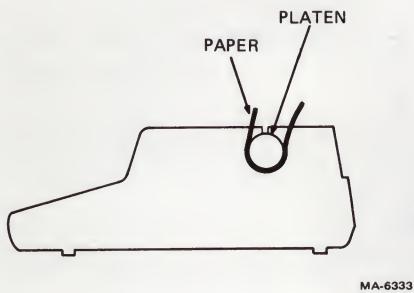


Figure 2-3 Single Sheet Paper Path

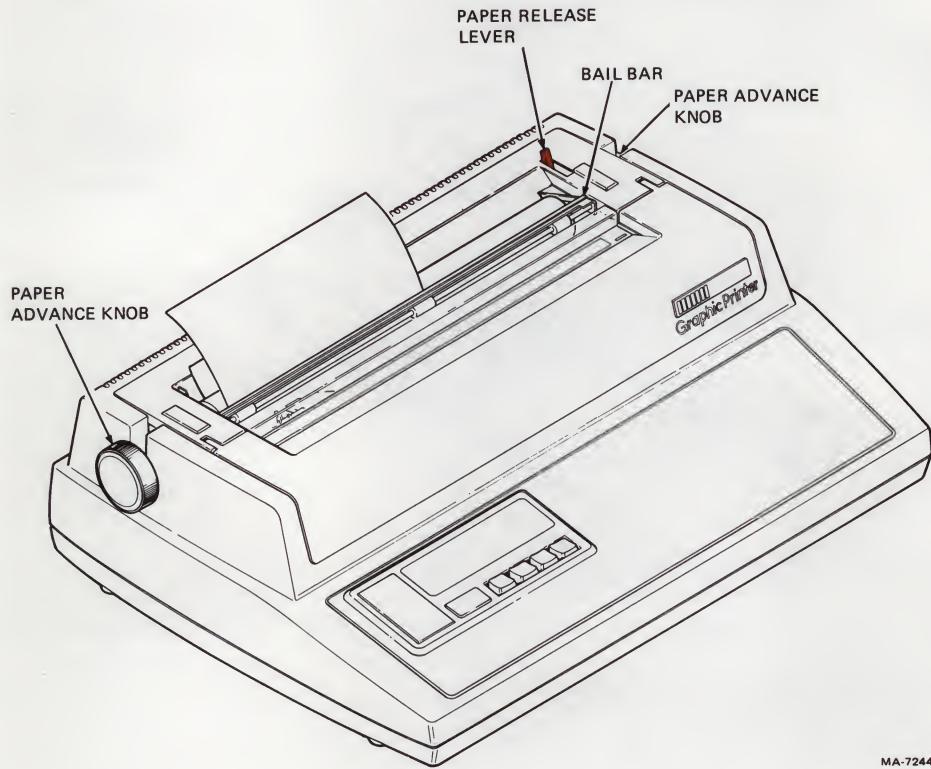


Figure 2-4 Loading Single Sheet Paper

Loading Friction Feed Paper

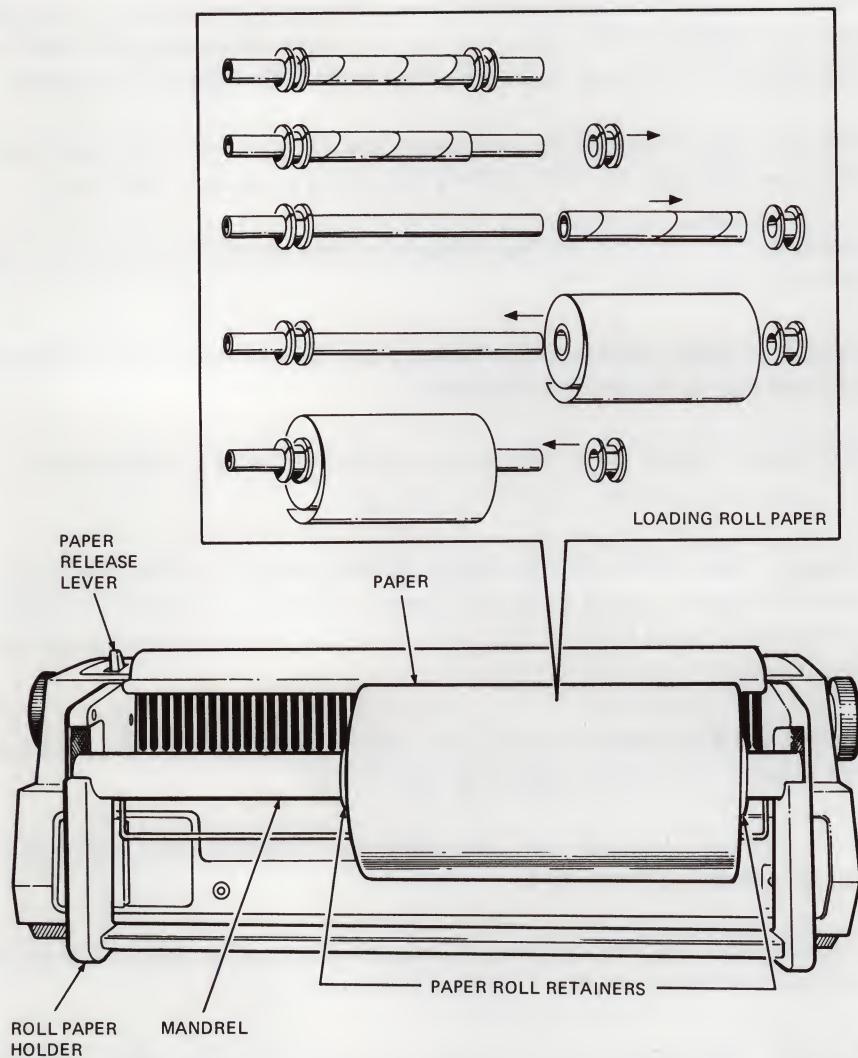
The following paragraphs describe how to load friction feed paper, including single sheet and roll paper. It is not necessary to turn the power off to load friction paper.

Single-Sheet – To use single sheets of paper in the DECwriter IV Graphic Printer, the operator must disable the paper out or paper low detection options (LAX34-PL or LAX34-LL) if either is installed. (To disable these options refer to the Options Chapter.) To load single sheets of paper, refer to Figures 2-3 and 2-4, and perform the following procedure.

1. Feed the sheet of paper under the platen from the back. Lift the bail bar and advance the paper, using the paper advance knob, until the top edge of the paper is even with the bottom edge of the paper.
2. Pull the paper release lever toward the front of the printer and position the paper to the left of the printer (as seen from the front).
3. Smooth the paper over the surface of the platen and align the top and bottom edges.
4. Push the paper release lever toward the back of the printer and lower the bail bar to its original position.
5. If needed, adjust the printhead as described later in this chapter.

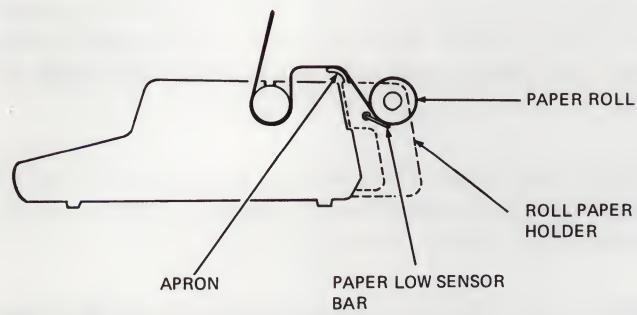
Roll Paper – The LAX34-RL roll paper holder option must be installed to use friction feed roll paper (refer to Options chapter). Perform the following procedure to load friction feed roll paper or preprinted forms into the graphic printer.

1. Remove the mandrel from the roll paper holder and slide one paper roll retainer from the mandrel (Figure 2-5).
2. Slide the roll of paper onto the mandrel. Replace the paper roll retainer previously removed.
3. Reinstall the mandrel on the roll paper holder assembly so the paper will feed from the bottom of the roll (Figure 2-6).
4. Position the paper roll to the left of the holder (as seen from the front). Make sure the paper roll retainers are touching the paper roll to prevent it from moving from side to side. Do not let the paper roll retainers touch the side of the roll paper holder. That creates unnecessary friction.
5. Feed the paper over the roll holder apron and under the platen from the back. Lift the bail bar and advance the paper, using the paper advance knob, until the top edge extends back over the apron (Figure 2-6). Make sure the paper does not pass under the paper low sensor (Figure 2-6).
6. Pull the paper release lever toward the front of the printer (Figure 2-5). Smooth the paper over the surface of the platen and line up the sides of the paper with the supply roll edges.
7. Push the paper release lever toward the back of the printer and lower the bail bar to its original position.
8. Adjust the printhead as described later in this chapter.



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Figure 2-5 Loading Roll Paper



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Figure 2-6 Roll Paper Path

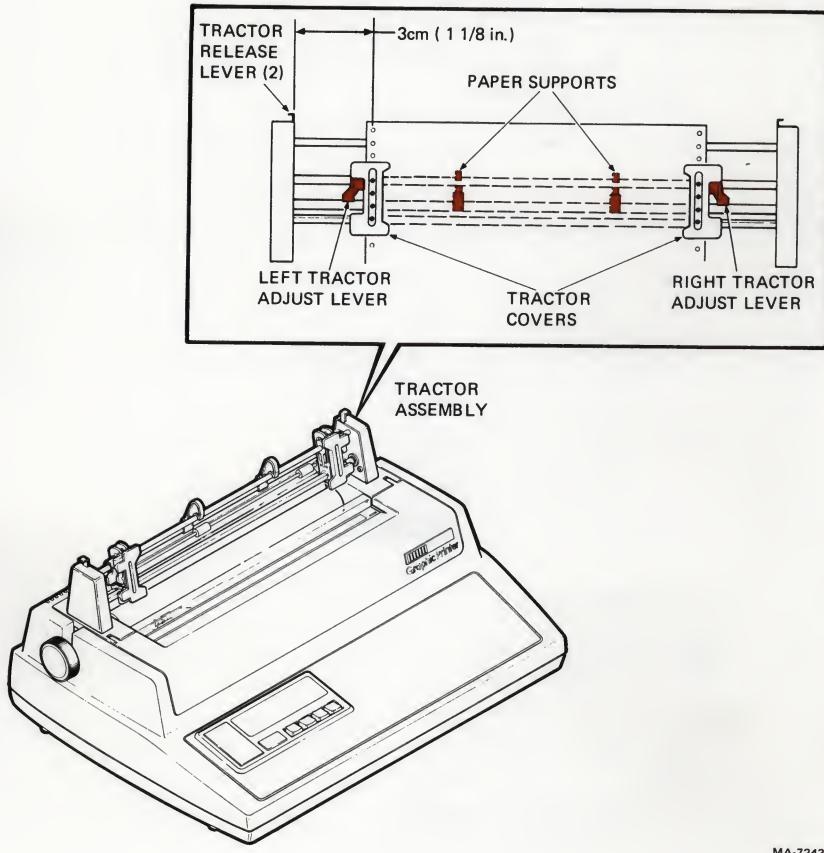


Figure 2-7 Loading Tractor Feed Paper

Loading Tractor Feed Paper/Forms

The following paragraphs describe how to load tractor feed paper or pre-printed forms into the DECwriter IV Graphic Printer. The LAX34-AL tractor option must be installed to use tractor feed paper. DIGITAL also recommends using the printer stand option (LAX34-SL) for the most effective paper feeding operation. Tractor feed paper may be loaded through the bottom, or from the back, of the printer. It is not necessary to turn power off when installing tractor feed paper. Perform the following procedure to load tractor feed paper.

NOTE: If paper is loaded from the back of the printer, the paper out detection option does not operate.

1. Make sure that the bail bar is behind the tractors. If not, remove the tractors and reinstall according to the LAX34-AL tractor option instructions in the Options chapter.
2. Pull the left and right tractor adjust levers toward the front of the printer to loosen the tractors (Figure 2-7).

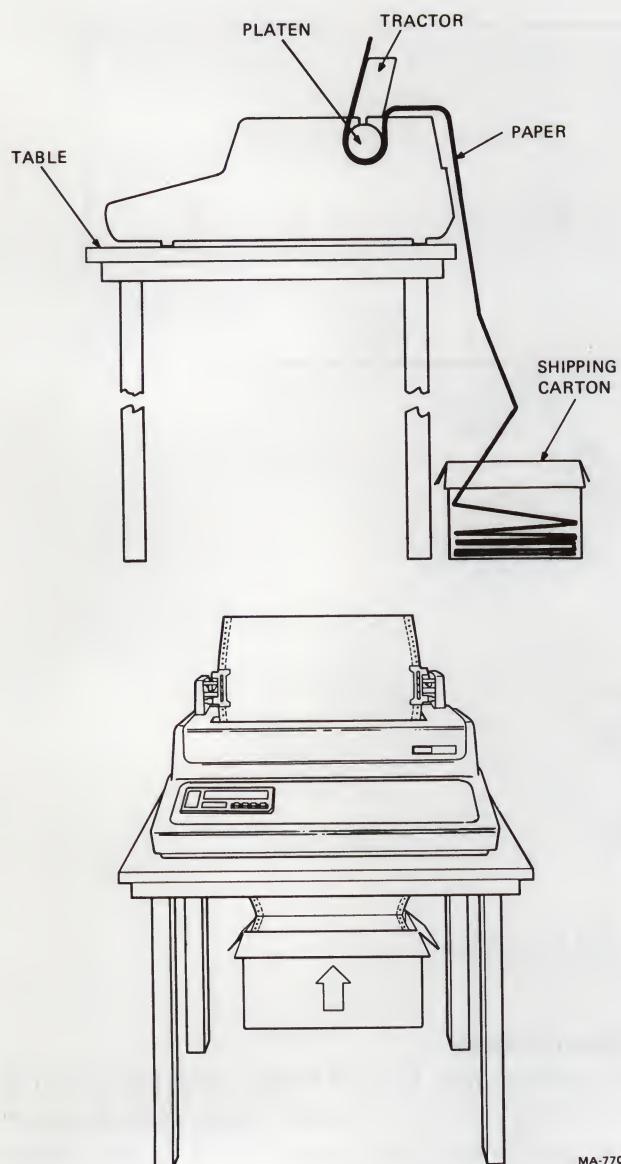


Figure 2-8 Tractor Feed Paper Path (Without Printer Stand)

NOTE: The following step is an initial adjustment only. Do not readjust the left tractor when reloading paper.

3. Position the left tractor so the pins are 3 cm (1-1/8 in) from the left side plate (Figure 2-7). Tighten the left tractor adjust lever.
4. Position the right tractor at about the same distance from the right side plate. Do not tighten the right tractor adjust lever.

NOTE: This provides margins for 13.2 inch paper. It may be necessary to reposition the right tractor when using smaller forms. Do not move the left tractor when using smaller forms.

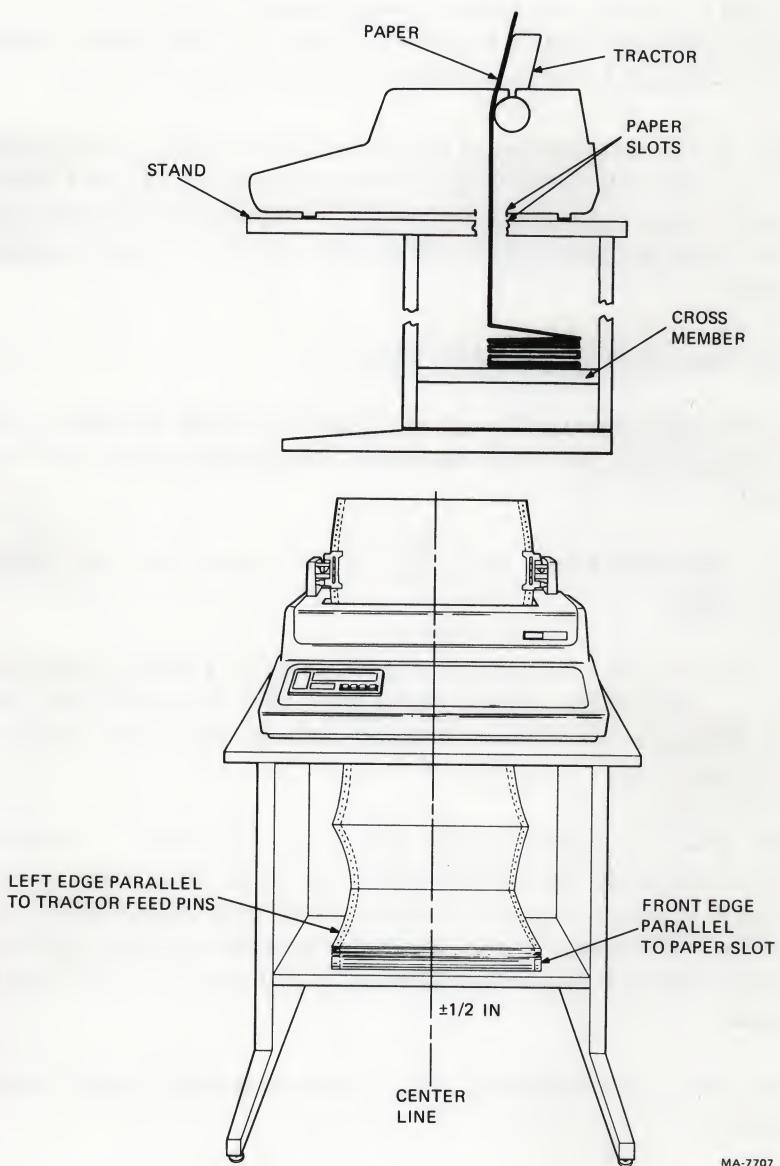


Figure 2-9 Tractor Feed Paper Path (With Printer Stand)

5. Open both tractor covers (Figure 2-7).
6. If you are not using the printer stand option position the printer as shown in Figure 2-8. Place the back edge of the printer parallel to, and slightly over, the edge of the table.
7. Position the paper to feed correctly into the printer.
 - a. If you are using the printer stand, place the paper/forms on the crossmember between the legs of the printer stand (Figure 2-9).

- b. If you are not using the printer stand, place the paper/forms on the floor behind the table as shown in Figure 2-8. The paper can be left in the shipping container if the container top is removed.

NOTE: If it is not possible to place the paper supply on the floor, place it on the table behind the printer. However, use the LAX34-SW paper tray accessory to prevent interference between the printout and supply paper unless the printer is continuously watched.

8. Feed the paper through the paper slot.

- a. If you are using the printer stand, align the paper parallel to the bottom paper slot and route the paper through the paper slot (Figure 2-9).

NOTE: Multipart forms may separate if loaded into the printer from the back.

- b. If you are not using the printer stand, feed the paper through the paper slot behind the platen. Using the paper advance knob, advance the paper until the top edge extends above the tractors (Figure 2-8).

NOTE: Feeding supply paper under the DECwriter IV Graphic Printer and through the bottom paper slot is not recommended unless the printer stand is used. When paper is loaded from the bottom without the printer stand, the paper perforations may catch on the table. This can cause the terminal to print uneven lines across the paper.

9. Place the left margin holes over the tractor feed pins. Close the left tractor cover.

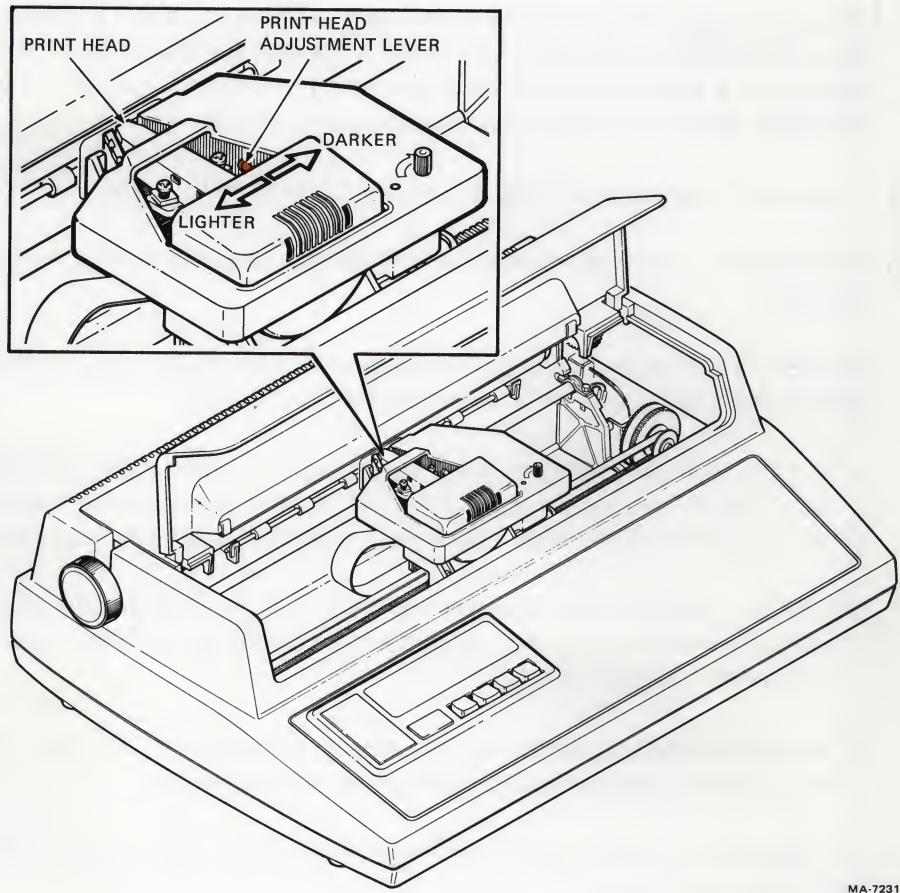
10. Position the right tractor to place the right margin holes over the tractor feed pins. Close the right tractor cover.

11. Tighten the right tractor adjust lever to clamp the right tractor in place.

CAUTION: Do not stretch the paper too tight. If the paper pulls against the tractor pins or is loose in the center, readjust the right tractor.

12. Position the paper supports one quarter of the distance from each tractor (Figure 2-7).

13. Make sure that the paper stack is centered directly under the tractors.



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Figure 2-10 Printhead Adjustment

14. Pull the paper release lever toward the front of the printer (Figure 2-5).
15. Adjust the printhead as described later in this chapter.
16. If necessary set the top of form as described later in this chapter.

PRINthead ADJUSTMENT

Perform the following procedure to adjust the printhead.

1. Make sure that the power ON/OFF switch is on. Press and lock the ON LINE/OFF key in the off (down) position.
2. Open the access cover and move the printhead adjustment lever all the way to the left (Figure 2-10).
3. Carefully move the printhead adjustment lever one position to the right.

4. Manually move the printhead to the right and left to check for smudging. If the ribbon smudges, first make sure that the paper is installed correctly. If the paper is installed correctly, move the printhead adjustment lever to the left until the smudging stops.
5. Close the access cover and press the CLEAR FAULT key.
6. Print a line of characters and check the printed characters for print quality.

NOTE: If the form ripples or is pulled by the printhead, the printhead is not adjusted correctly. Repeat steps 2 through 6.

- a. If data was not being printed during step 1, press and lock the SELF TEST key in the down position to print the status message. Release the SELF TEST key after the status message is printed.

NOTE: While off-line, pressing the SELF TEST key causes the printer to disconnect, exit graphic mode, clear the contents of the input buffer, and print a status message.

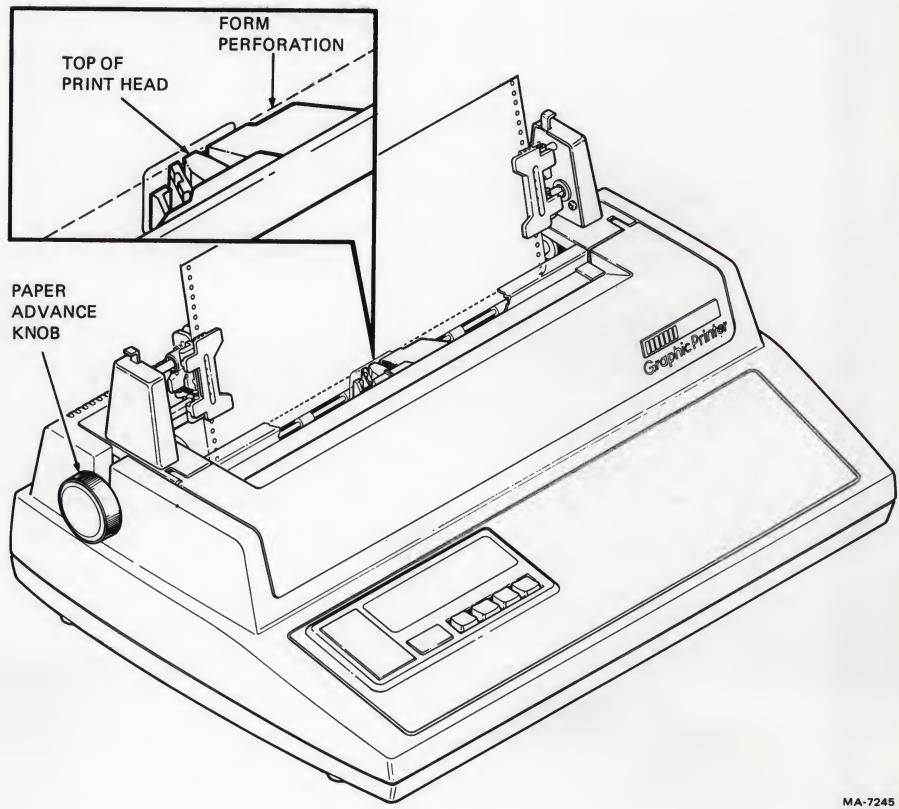
- b. If data was being printed during step 1, release the ON LINE/OFF key to allow the printer to print a line of characters.
7. If necessary, repeat steps 3 through 6 until the printed characters are clear and sharp.

SETTING TOP OF FORM

Perform the following procedure to set the top of form.

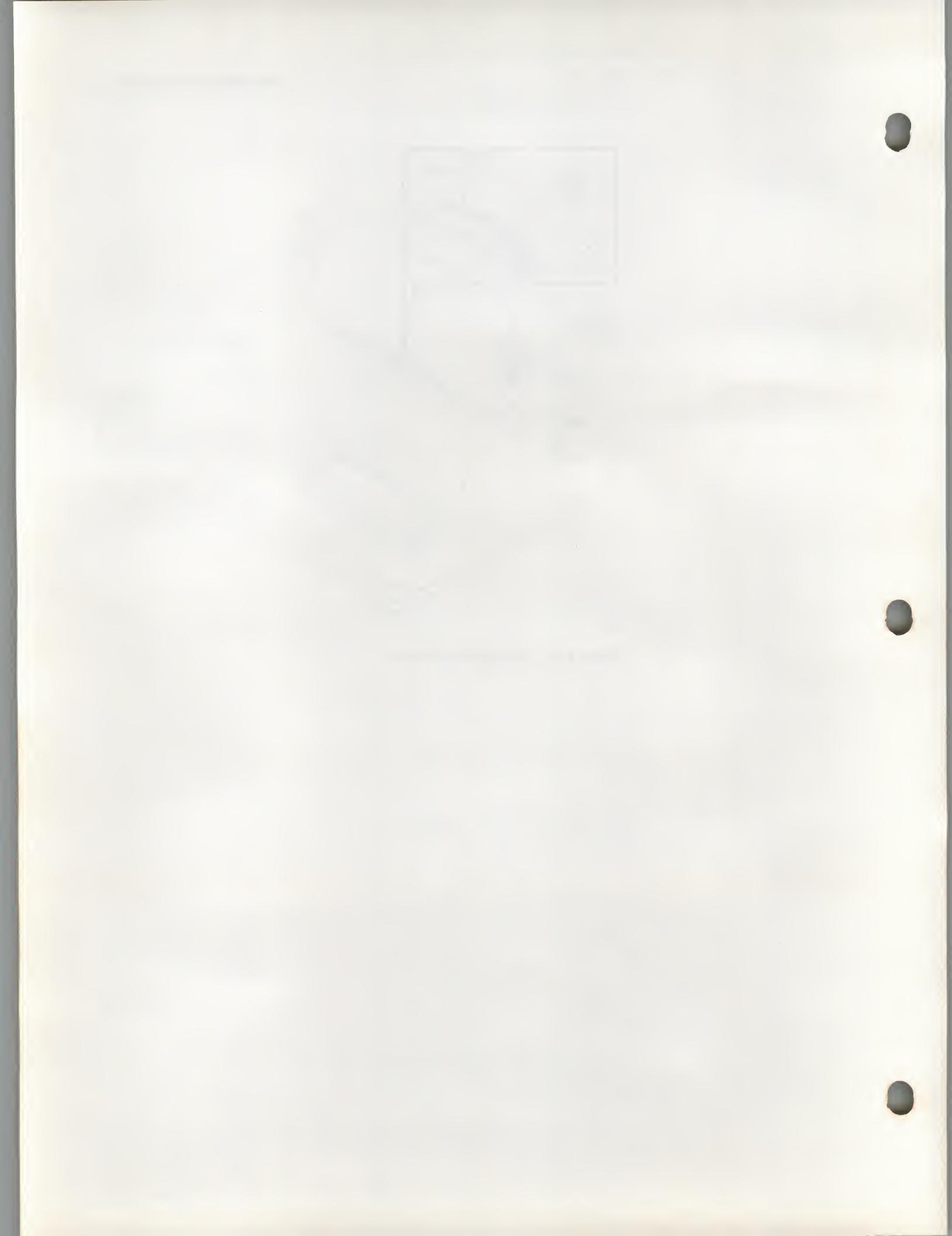
1. Place the ON LINE/OFF key in the off (down) position.
2. Turn the paper advance knob until the form perforation is even with the top of the printhead (Figure 2-11).
3. Press the SET TOF key. If the top margin is set to any line other than line one, the paper immediately advances to the top margin.

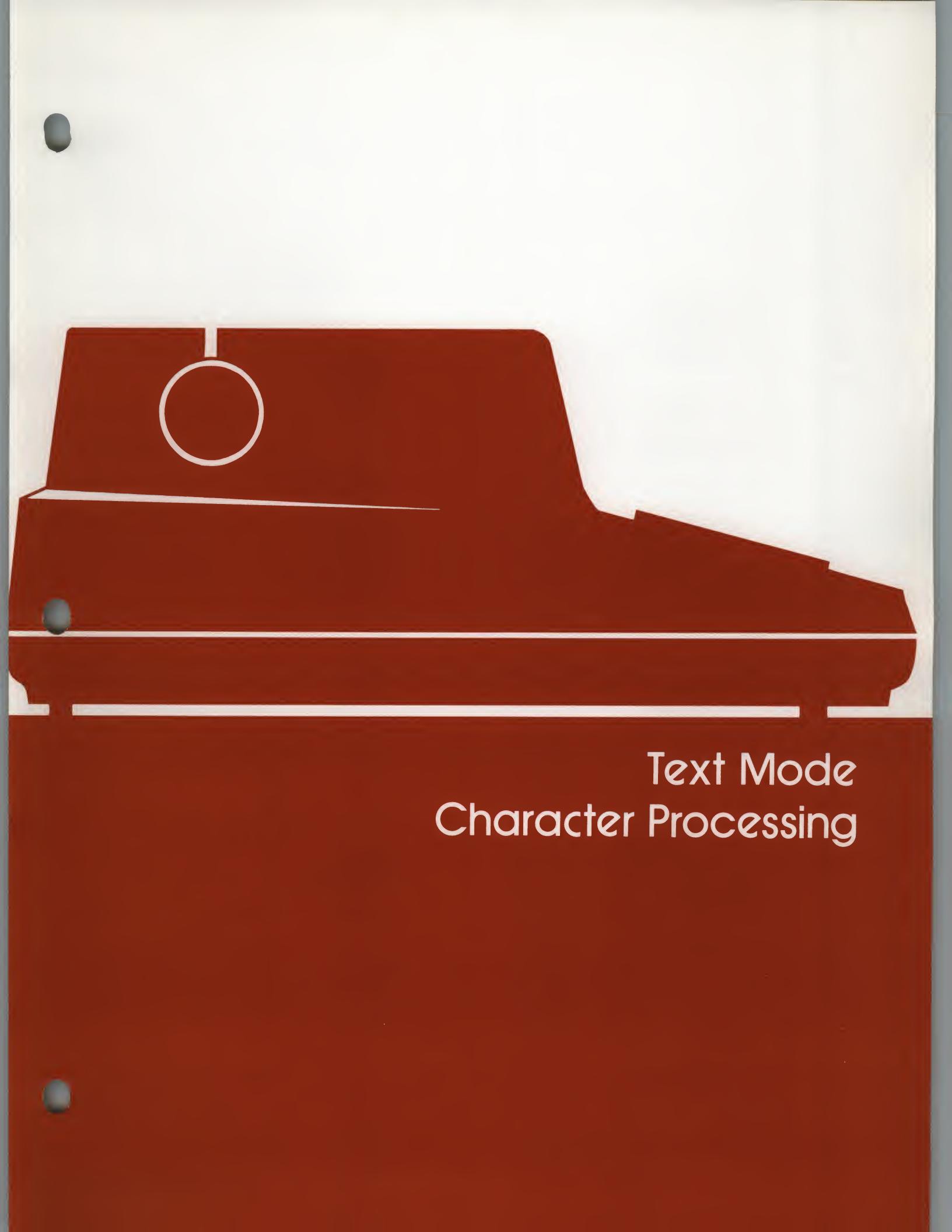
NOTE: Do not confuse top of form with top margin. Top of form is the physical top edge of the paper. The top margin is the first printable line on the page.



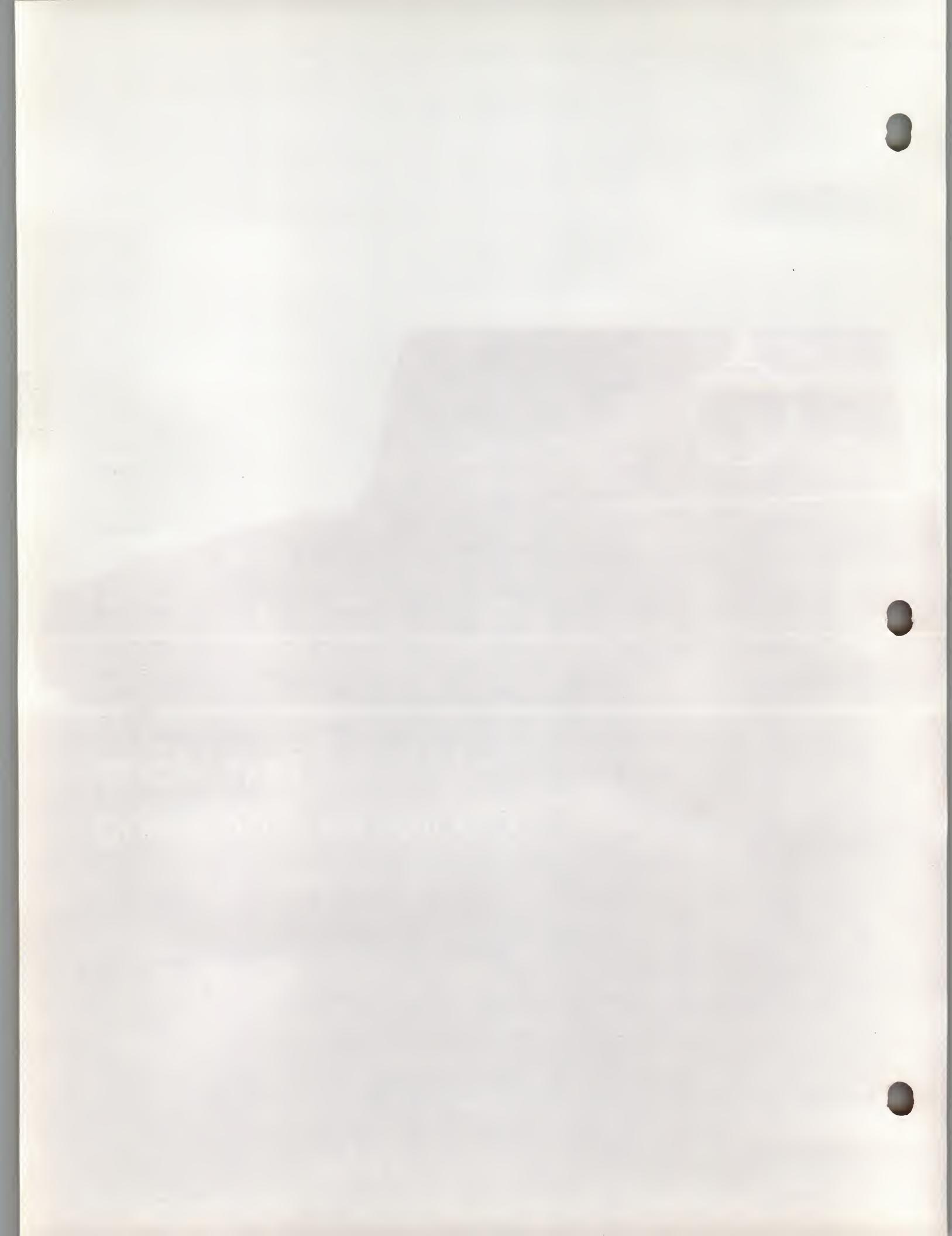
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Figure 2-11 Setting Top of Form





Text Mode Character Processing



3

TEXT MODE CHARACTER PROCESSING

GENERAL

The DECwriter IV Graphic Printer's response to received characters depends on the printing mode selected. There are two basic printing modes; text mode and graphic mode. This chapter describes the graphic printers' response to characters received while the printer is operating in text mode. Graphic mode, and the method of processing characters while in graphic mode, is fully described in the Graphic Mode Character Processing chapter.

The graphic printer processes characters according to American National Standards Institute (ANSI) standards X3.64-1979, X3.4-1977 and X3.41-1977. The ANSI system of character processing is based on categories of characters in the American National Standard Code for Information Interchange (ASCII) chart (Figure 3-1). A character's category is determined by its position in the ASCII chart.

The charts' characters can be divided into two general categories, printable characters and control characters. In the eight column ASCII chart, columns zero and one show the control characters. The rest of the chart contains printable characters (except for SP and DEL). SP (space) and DEL (delete) are always the same control characters regardless of the character set selected.

NOTE: SP can be considered either an information separator control character or a printable character. It can be considered a printable character because it takes up space both in the printer memory, and on the paper when printed.

The following paragraphs describe the graphic printers' response to both printable characters and control characters while operating in text mode.

PRINTABLE CHARACTERS

In text mode, ASCII characters are printed as they are received by the graphic printer. If the active column is not greater than the right margin, each received character is printed and the active column is incremented. If the previous character received is printed at the right margin, an automatic carriage return and line feed is executed before the next character is processed.

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1				
		COLUMN 0		1		2		3		4		5		6		7				
B4	B3	B2	B1	ROW																
0	0	0	0	0	NUL	0 0	DLE	20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
0	0	0	1	1	SOH	1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
0	0	1	0	2	STX	2 2 2	DC2	22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
0	0	1	1	3	ETX	3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
0	1	0	0	4	EOT	4 4 4	DC4	24 20 14	\$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
0	1	0	1	5	ENQ	5 5 5	NAK	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
0	1	1	0	6	ACK	6 6 6	SYN	26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
0	1	1	1	7	BEL	7 7 7	ETB	27 23 17	/	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
1	0	0	0	8	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
1	0	0	1	9	HT	11 9 9	EM	31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
1	0	1	0	10	LF	12 10 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
1	0	1	1	11	VT	13 11 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	L	133 91 5B	k	153 107 6B	{	173 123 7B
1	1	0	0	12	FF	14 12 C	FS	34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	|	174 124 7C
1	1	0	1	13	CR	15 13 D	GS	35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	J	135 93 5D	m	155 109 6D	}	175 125 7D
1	1	1	0	14	SO	16 14 E	RS	36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	A	136 94 5E	n	156 110 6E	~	176 126 7E
1	1	1	1	15	SI	17 15 F	US	37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	—	137 95 5F	o	157 111 6F	DEL	177 127 7F

KEY

ASCII CHARACTER

ESC	33	OCTAL
	27	DECIMAL
	1B	HEX

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Figure 3-1 ASCII Chart

CONTROL CHARACTERS

A control character is a single character control function used to control printing and character processing. Control characters are not printed.

The DECwriter IV Graphic Printer responds to the control characters listed in Table 3-1. Table 3-1 also lists each control character's mnemonic, and function when operating in text mode. All other control characters received by the printer cause no action.

NOTE: Each control function listed in this chapter has a mnemonic. The mnemonic is an abbreviation of the control function name.

Table 3-1 Text Mode ANSI Control Characters

Name	Mnemonic	Octal Code	Function
Null	NUL	000	No operation (not stored in the input buffer) used as fill characters (refer to Communication chapter)
Bell	BEL	007	Sounds audible bell tone
Backspace	BS	010	Moves active column left one column unless active column is at left margin. This condition causes no action (active column and active line are described later in this chapter)
Horizontal tab	HT	011	Advances active column to next horizontal tab stop or to left margin on next line if there are no more tab stops on the line
Line feed	LF	012	Advances active line one line or to top margin of next page if active line is at bottom margin. Active column also set to left margin if line feed new line mode is on
Vertical tab	VT	013	Advances active line to next vertical tab stop or top margin of next page if there are no more tabs on the page. Line feed new line mode does not affect this character

Table 3-1 Text Mode ANSI Control Characters (Cont)

Name	Mnemonic	Octal Code	Function
Form feed	FF	014	Advances active line to top margin of next page. Line feed new line mode does not affect this character
Carriage return	CR	015	Returns active column to left margin.
Shift out	SO	016	Switches the DECwriter IV Graphic Printer to the G1 printable character set
Shift in	SI	017	Switches the DECwriter IV Graphic Printer to G0 printable character set
Cancel	CAN	030	Immediately ends any control or escape sequence
Substitute	SUB	032	Immediately ends any control or escape sequence. Any character received with errors are replaced by the SUB character, SUB characters printed as ☺
Escape	ESC	033	Interpreted as introducer of an escape sequence
Delete	DEL	177	No operation (not stored in input buffer)

Escape and Control Sequences

Escape and control sequences are used to provide additional controls not provided by the control characters in the character set. These sequences are multiple character control functions used to control character printing and processing. They are not printed. Escape and control sequences are defined in ANSI standards X3.41 – 1977 and X3.64 – 1979.

The characters used in escape and control sequences throughout this chapter are shown (but not defined) using the ASCII character set. The case of the characters used in a sequence is significant and must be sent to the printer exactly as shown. These characters are spaced apart for clarity only. The space character (octal 040) is never used in any escape or control sequence. The octal equivalent of each sequence is provided as the main reference in this book. The ASCII chart (Figure 3-1) contains the conversion to hexadecimal and decimal for your convenience.

Escape Sequence Format – The format of an escape sequence is as follows.

ESC	I...I	F
033	040 – 057	060 – 176
Escape sequence introducer	Intermediate characters (any number of characters – zero or more)	Final character (one character)

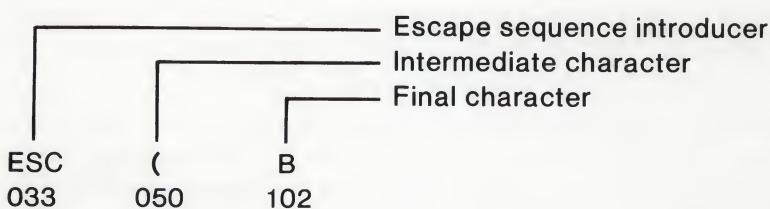
The escape sequence introducer is the ESC control character (octal 033). When the ESC character is received, the next characters received are not printed, but stored, to be used as part of the sequence.

If the characters received after the ESC character are in the 040 – 057 octal range (Figure 3-1, column two), they are intermediate characters. These characters are stored as part of the sequence.

If the character received after the ESC character is in the 060 – 176 octal range (Figure 3-1, columns three through seven), it is a final character. Final characters in the 100 – 176 octal range (Figure 3-1, columns four through seven) are reserved for standard ANSI use. Final characters in the 060 – 077 octal range (Figure 3-1, column three) are reserved for private use.

The final character indicates the end of the escape sequence. The intermediate and final characters together define the function of the sequence. The graphic printer performs the action specified by the sequence, then continues to print data.

Example – The following sequence is used to designate the USASCII character set as G0.



Control Sequence Format – The format of a DECwriter Graphic Printer control sequence is as follows.

CSI	P...P	F
033 133	060 - 077	100 - 176
Control sequence introducer	Parameter (zero or more characters)	Final (one character)

The control sequence introducer (CSI) consists of the ESC (octal 033) and [(octal 133) characters. It is used to gain the extended functionality of the 8-bit environment while using 7-bit characters. After the CSI characters are received, characters received are not printed, but stored for use as part of the sequence.

If the characters received after the CSI characters are in the 060–077 octal range (Figure 3-1, column four), the characters are parameter characters. A parameter character modifies the action of the sequence.

Parameters are interpreted as unsigned decimal integers, with the most significant digit transmitted first. Leading zeros are allowed but not necessary. Each parameter in a group of numeric parameters is separated by the delimiter ";" (octal 073).

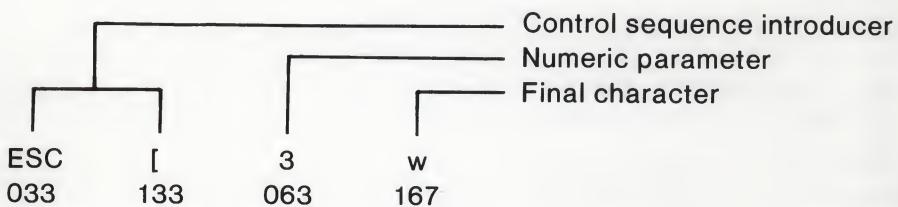
If no decimal value is specified for a parameter character in a sequence sent to the graphic printer, a zero value is assumed for the parameter. The limit for a numeric parameter is 254 (decimal). Limit numeric parameters to 16 per string.

In this user guide, parameters are shown as actual values or are designated as Pn, Pn1, Pn2, etc. In the octal representation of the sequences, parameter characters are shown as three asterisks (***)�.

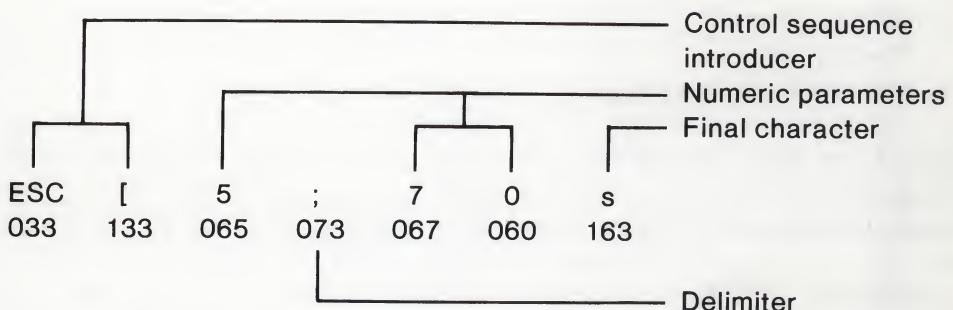
NOTE: If the ? character (octal 077) occurs at the beginning of a string of parameters, the control sequence is processed as a DIGITAL private sequence.

If the character received after the CSI characters is in the 100 – 176 octal range (Figure 3-1, column four through seven,) it is a final character. Final characters in the 100 – 157 octal range (Figure 3-1, columns four through six) are reserved for standard ANSI use. Final characters in the 160 – 176 octal range (Figure 3-1, column seven) are reserved for private use. The final character indicates the end of a control sequence. The intermediate and final characters together define the function of the sequence. The graphic printer performs the action specified by the sequence, then continues to print data.

Example - The following sequence is used to set horizontal pitch to 13.2 characters per inch.



Example - The following sequence is used to set the left margin to column 5 and the right margin to column 70.



Error Recovery

The DECwriter IV Graphic Printer usually recovers from control function errors by performing as much of the function as possible. Errors include invalid control functions, control characters embedded in escape or control sequences, and parameters out of range. The following specific error recovery techniques are used by the graphic printer.

- A control function not recognized by the graphic printer is ignored.
- Unsupported control functions (valid control functions not listed in this manual) are ignored.
- If a control character, other than ESC (escape), CAN (cancel), or SUB (substitute) is sent within an escape or control sequence, the graphic printer performs the control characters' function as if it were received before the sequence. The printer then continues to process the sequence.
- If the CAN character (octal 030) or SUB character (octal 032) is received during an escape or control sequence, the sequence ends immediately and the printer returns to text mode character processing.
- If the ESC character is received during a sequence, the sequence ends immediately and the printer begins to process the new sequence.

Detailed Sequence Definitions

The following paragraphs describe in detail the escape and control sequences to which the DECwriter IV Graphic Printer responds. These sequences are described in the following order.

- Line Feed New Line Mode
- Printable Character Set Designation
- Active Column and Active Line
- Horizontal Pitch (Characters Per Inch)
- Horizontal Margins
- Horizontal Tabs
- Vertical Pitch
- Form Length
- Vertical Margins
- Vertical Tabs
- Product Identification

Line Feed New Line Mode – Line feed new line mode defines the line feed control character's function. When this mode is off, and the line feed control character (LF) is received, the graphic printer increments the active line and advances the paper one line. If this mode is on, when the LF character is received it returns the active column to the left margin in addition to the usual functions. The following sequences are used to enable or disable line feed new line mode.

Name	Mnemonic	Sequence						Function
Line feed new line mode	LNM	ESC	[	2	0	h	150	Set line feed new line mode on.
		033	133	062	060			Set line feed new line mode off.
		ESC	[	2	0	I	154	
		033	133	062	060			

Printable Character Set Designation – The 7-bit ASCII chart can be expanded to allow a larger selection of characters without increasing the number of bits the terminal must use to describe each unique character.

Any two of these character sets can be considered active at any time. The active character sets are designated by the computer as G0 and G1 using the select character set (SCS) sequence. The shift in (SI, octal 017) and shift out (SO, octal 016) control characters specify which of the two designated character sets (G0 or G1) is used at one time. Shift in (SI) selects the G0 character set and shift out (SO) selects the G1 character set. The designated character sets are used until another select character set (SCS) sequence is received. The G0 and G1 character sets can be redesignated by the computer using the select character set (SCS) sequence as often as required.

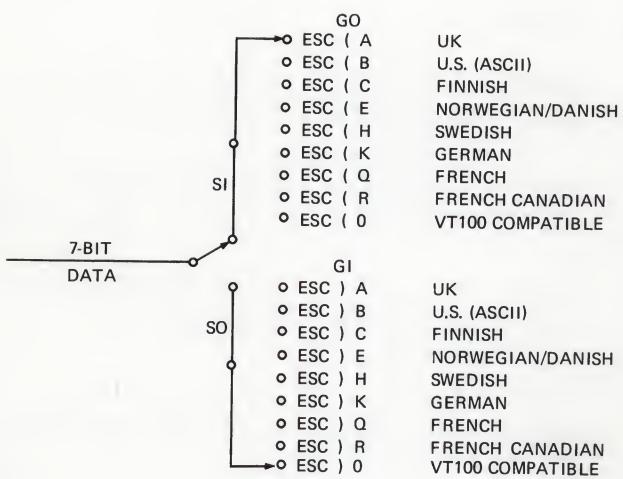


Figure 3-2 Character Set Selection Example

Figure 3-2 shows a character set selection example. The UK character set is designated as the G0 character set. The VT100 compatible character set is designated as the G1 character set. When the graphic printer receives the control character SI, the ASCII character set is selected. When the printer receives the control character SO, the VT100 compatible character set is selected. Tables 3-2 through 3-10 show the graphic character sets.

The USASCII character set is the power up default selection. The following sequences designate the DECwriter IV Graphic Printer G0 character set.

Name	Mnemonic	Sequence	Function
Select character set	SCS	ESC 033 (050	Select the United Kingdom character set.
		101	
		102	Select the USASCII character set.
		103	Select the Finnish character set.
		105	Select the Norwegian / Danish character set.
		110	Select the Swedish character set.

Name	Mnemonic	Sequence			Function
		ESC	(	K	Select the German character set.
		033	050	113	
		ESC	(	Q	Select the French Canadian character set.
		033	050	121	
		ESC	(	R	Select the French character set.
		033	050	122	
		ESC	(	O	Select the VT100 compatible character set.
		033	050	060	

The following sequences designate the G1 character sets.

Name	Mnemonic	Sequence			Function
Select character set	SCS	ESC	)	A	Select the United Kingdom character set
		033	051	101	
		ESC	)	B	Select the USASCII character set
		033	051	102	
		ESC	)	C	Select the Finnish character set
		033	051	103	
		ESC	)	E	Select the Norwegian/Danish character set
		033	051	105	
		ESC	)	H	Select the Swedish character set
		033	051	110	
		ESC	)	K	Select the German character set
		033	051	113	
		ESC	)	Q	Select the French Canadian character set
		033	051	121	
		ESC	)	R	Select the French character set
		033	051	122	
		ESC	)	O	Select the VT100 compatible character set
		033	051	060	

Table 3-2 United Kingdom Character Set

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1				
		COLUMN 0		1		2		3		4		5		6		7				
B4	B3	B2	B1	ROW																
0	0	0	0	0	NUL	0 0 0		20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
0	0	0	1	1	DC1 (XON)	1 1 1	21 17 11	!	41 33 21		1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
0	0	1	0	2		2 2 2	22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72	
0	0	1	1	3	DC3 (XOFF)	3 3 3	23 19 13	£	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73	
0	1	0	0	4		4 4 4	24 20 14	\$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74	
0	1	0	1	5	ENQ	5 5 5	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75	
0	1	1	0	6		6 6 6	26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76	
0	1	1	1	7	BEL	7 7 7	27 23 17	,	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77	
1	0	0	0	8	BS	10 8 8	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
1	0	0	1	9	HT	11 9 9	31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
1	0	1	0	10	LF	12 10 A	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A	
1	0	1	1	11	VT	13 11 B	33 27 1B	+	53 43 28	;	73 59 38	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
1	1	0	0	12	FF	14 12 C	34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	|	174 124 7C	
1	1	0	1	13	CR	15 13 D	35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
1	1	1	0	14	SO	16 14 E	36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E	
1	1	1	1	15	SI	17 15 F	37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	-	137 95 5F	o	157 111 6F	DEL	177 127 7F	

KEY

ASCII CHARACTER

ESC	33	OCTAL
	27	DECIMAL
	1B	HEX

Table 3-3 United States Character Set

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1		
		COLUMN 0		1		2		3		4		5		6		7		
B4	B3	B2	B1	ROW														
0	0	0	0	0	NUL	0		20	SP	40	0	60	@	100	P	120	p	160
						0		16		32	0	48		64		80		96
						0		10		20	1	31		40		50		60
0	0	0	1	1	DC1 (XON)	1		21	!	41	1	61	A	101	Q	121	a	141
						1		17		33	1	49		65		81		97
						1		11		21	2	31		41		51		61
0	0	1	0	2		2		22	"	42	2	62	B	102	R	122	b	142
						2		18		34	2	50		66		82		98
						2		12		22	3	32		42		52		62
0	0	1	1	3	DC3 (XOFF)	3		23	#	43	3	63	C	103	S	123	c	143
						3		19		35	3	51		67		83		99
						3		13		23	3	33		43		53		63
0	1	0	0	4		4		24	\$	44	4	64	D	104	T	124	d	144
						4		20		36	4	52		68		84		100
						4		14		24	5	34		44		54		64
0	1	0	1	5	ENQ	5		25	%	45	5	65	E	105	U	125	e	145
						5		21		37	5	53		69		85		101
						5		15		25	5	35		45		55		65
0	1	1	0	6		6		26	&	46	6	66	F	106	V	126	f	146
						6		22		38	6	54		70		86		102
						6		16		26	6	36		46		56		66
0	1	1	1	7	BEL	7		27	/	47	7	67	G	107	W	127	g	147
						7		23		39	7	55		71		87		103
						7		17		27	7	37		47		57		67
1	0	0	0	8	BS	10		30	(	50	8	70	H	110	X	130	h	150
						8		24		40	8	56		72		88		104
						8		18		28	8	38		48		58		68
1	0	0	1	9	HT	11		31	)	51	9	71	I	111	Y	131	i	151
						9		25		41	9	57		73		89		105
						9		19		29	9	39		49		59		69
1	0	1	0	10	LF	12		32	*	52	:	72	J	112	Z	132	j	152
						10		26		42	8	58		74		90		106
						A		1A		2A	8	3A		4A		5A		6A
1	0	1	1	11	VT	13		33	+	53	;	73	K	113	[	133	k	153
						11		27		43	;	59		75		91		107
						B		1B		2B	;	3B		4B		5B		6B
1	1	0	0	12	FF	14		34	,	54	<	74	L	114	\	134	l	154
						12		28		44	8	60		76		92		108
						C		1C		2C	8	3C		4C		5C		6C
1	1	0	1	13	CR	15		35	-	55	=	75	M	115	]	135	m	155
						13		29		45	8	61		77		93		109
						D		1D		2D	8	3D		4D		5D		6D
1	1	1	0	14	SO	16		36	.	56	>	76	N	116	^	136	n	156
						14		30		46	8	62		78		94		110
						E		1E		2E	8	3E		4E		5E		6E
1	1	1	1	15	SI	17		37	/	57	?	77	O	117	-	137	o	157
						15		31		47	8	63		79		95		111
						F		1F		2F	8	3F		4F		5F		6F

KEY

ASCII CHARACTER

ESC	33
	27
	1B

OCTAL
DECIMAL
HEX

Table 3-4 France Character Set

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1		
		COLUMN 0		1		2		3		4		5		6		7		
B4	B3	B2	B1	ROW														
0	0	0	0	0	NUL	0		20	SP	40	0	60	à	100	P	120	'	140
						0		16		32		48		64		80	96	112
						0		10		20		30		40		50	60	70
0	0	0	1	1	DC1 (XON)	1		21	!	41	1	61	A	101	Q	121	a	141
						1		17		33		49		65		81	97	113
						1		11		21		31		41		51	61	71
0	0	1	0	2		2		22	"	42	2	62	B	102	R	122	b	142
						2		18		34		50		66		82	98	114
						2		12		22		32		42		52	62	72
0	0	1	1	3	DC3 (XOFF)	3		23	£	43	3	63	C	103	S	123	c	143
						3		19		35		51		67		83	99	115
						3		13		23		33		43		53	63	73
0	1	0	0	4		4		24	\$	44	4	64	D	104	T	124	d	144
						4		20		36		52		68		84	100	116
						4		14		24		34		44		54	64	74
0	1	0	1	5	ENQ	5		25	%	45	5	65	E	105	U	125	e	145
						5		21		37		53		69		85	101	117
						5		15		25		35		45		55	65	75
0	1	1	0	6		6		26	&	46	6	66	F	106	V	126	f	146
						6		22		38		54		70		86	102	118
						6		16		26		36		46		56	66	76
0	1	1	1	7	BEL	7		27	'	47	7	67	G	107	W	127	g	147
						7		23		39		55		71		87	103	119
						7		17		27		37		47		57	67	77
1	0	0	0	8	BS	10		30	(	50	8	70	H	110	X	130	h	150
						8		24		40		56		72		88	104	120
						8		18		28		38		48		58	68	78
1	0	0	1	9	HT	11		31	)	51	9	71	I	111	Y	131	i	151
						9		25		41		57		73		89	105	121
						9		19		29		39		49		59	69	79
1	0	1	0	10	LF	12		32	*	52	:	72	J	112	Z	132	j	152
						10		26		42		58		74		90	106	122
						A		1A		2A		3A		4A		5A	6A	7A
1	0	1	1	11	VT	13		33	+	53	;	73	K	113	•	133	k	153
						11		27		43		59		75		91	107	123
						B		1B		2B		3B		4B		5B	6B	7B
1	1	0	0	12	FF	14		34	,	54	<	74	L	114	ç	134	l	154
						12		28		44		60		76		92	108	124
						C		1C		2C		3C		4C		5C	6C	7C
1	1	0	1	13	CR	15		35	-	55	=	75	M	115	ş	135	m	155
						13		29		45		61		77		93	109	125
						D		1D		2D		3D		4D		5D	6D	7D
1	1	1	0	14	SO	16		36	.	56	>	76	N	116	^	136	n	156
						14		30		46		62		78		94	110	126
						E		1E		2E		3E		4E		5E	6E	7E
1	1	1	1	15	SI	17		37	/	57	?	77	O	117	-	137	o	157
						15		31		47		63		79		95	111	127
						F		1F		2F		3F		4F		5F	6F	7F

KEY

ASCII CHARACTER	ESC	33	OCTAL
		27	DECIMAL
		1B	HEX

Table 3-5 Germany Character Set

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1			
		COLUMN 0		1		2		3		4		5		6		7			
B4	B3	B2	B1	ROW															
0	0	0	0	0	NUL	0	20	SP	40	0	60	§	100	P	120	'	140		
0	0	0	0	1	DC1 (XON)	21	!	41	33	1	61	A	101	Q	121	a	141		
0	0	0	1	1		17		21	33	49	41		65		81	97	q		
0	0	1	0	2		22	"	42	34	2	62	B	102	R	122	b	142		
0	0	1	1	3	DC3 (XOFF)	23	#	43	35	3	63	C	103	S	123	c	143		
0	1	0	0	4		19	\$	44	36	4	64	D	104	T	124	d	144		
0	1	0	1	5	ENQ	13		23	24		51		67		83	99	s	163	
0	1	0	0	4		20		24	36	4	52		43		53	63		115	
0	1	0	1	5		14		24	37		33							73	
0	1	0	1	5		21		25	37	5	65	E	105	U	125	e	145	u	165
0	1	1	0	6		15		25	37	53	53		69		85	101		117	
0	1	1	0	6		26	&	46	38	6	66	F	106	V	126	f	146	v	166
0	1	1	0	6		22		26	38	54	54		70		86	102		118	
0	1	1	1	7	BEL	17		27	39	7	67	G	107	W	127	g	147	w	167
0	1	1	1	7		23		27	39	55	55		71		87	103		119	
0	1	1	1	7		17		27	37	35	35		45		57	67		77	
1	0	0	0	8	BS	10	CAN	30	(8	70	H	110	X	130	h	150	x	170
1	0	0	0	8		8		40	40	8	56		72		88	104		120	
1	0	0	0	8		18		28	38	38	38		48		58	68		78	
1	0	0	1	9	HT	11		31)	9	71	I	111	Y	131	i	151	y	171
1	0	0	1	9		9		25	41	57	57		73		89	105		121	
1	0	0	1	9		9		19	29	39	39		49		59	69		79	
1	0	1	0	10	LF	12	SUB	32	*	52	:	J	112	Z	132	j	152	z	172
1	0	1	0	10		10		42	52	58	58		74		90	106		122	
1	0	1	1	11	VT	13	ESC	33	+	53	;	K	113	Ä	133	k	153	ä	173
1	0	1	1	11		11		27	43	59	59		75		91	107		123	
1	0	1	1	11		B		1B	2B	3B	3B		4B		5B	6B		7B	
1	1	0	0	12	FF	14		34	,	54	<	L	114	Ö	134	l	154	ö	174
1	1	0	0	12		12		28	44	60	74		76		92	108		124	
1	1	0	0	12		C		1C	2C	3C	4C		4C		5C	6C		7C	
1	1	0	1	13	CR	15		35	-	55	=	M	115	Ü	135	m	155	ü	175
1	1	0	1	13		13		29	45	61	75		77		93	109		125	
1	1	0	1	13		D		1D	2D	3D	4D		4E		5D	6D		7D	
1	1	1	0	14	SO	16		36	.	56	>	N	116	À	136	n	156	ß	176
1	1	1	0	14		14		30	46	62	76		78		94	110		126	
1	1	1	0	14		E		1E	2E	3E	4E		4E		5E	6E		7E	
1	1	1	1	15	SI	17		37	/	57	?	O	117	—	137	o	157	DEL	177
1	1	1	1	15		F		31	47	63	77		79		95	111		127	
1	1	1	1	15		F		1F	2F	3F	4F		4F		5F	6F		7F	

KEY

ASCII CHARACTER

ESC	33
	27
	1B

OCTAL
DECIMAL
HEX

Table 3-6 Finland Character Set

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
		COLUMN 0		1		2		3		4		5		6		7	
B4	B3	B2	B1	ROW													
0	0	0	0	0	NUL	0	0	20	16	SP	40	32	20	0	60	48	30
0	0	0	1	1	DC1 (XON)	21	17	!	41	1	61	49	41	A	101	65	51
0	0	1	0	2		22	18	"	42	2	62	50	32	B	102	66	42
0	0	1	1	3	DC3 (XOFF)	23	19	#	43	3	63	51	33	C	103	67	43
0	1	0	0	4		24	20	\$	44	4	64	52	34	D	104	68	44
0	1	0	1	5	ENQ	5	21	%	45	5	65	53	35	E	105	69	45
0	1	1	0	6		25	22	&	46	6	66	54	36	F	106	70	46
0	1	1	1	7	BEL	7	23	'	47	7	67	55	37	G	107	71	47
1	0	0	0	8	BS	10	24	(	50	8	70	56	38	H	110	72	48
1	0	0	1	9	HT	11	25	)	51	9	71	57	39	I	111	73	49
1	0	1	0	10	LF	12	26	*	52	:	72	58	3A	J	112	74	4A
1	0	1	1	11	VT	13	27	+	53	;	73	59	3B	K	113	75	4B
1	1	0	0	12	FF	14	28	,	54	<	74	60	3C	L	114	76	4C
1	1	0	1	13	CR	15	29	-	55	=	75	61	3D	M	115	77	4D
1	1	1	0	14	SO	16	30	.	56	>	76	62	3E	N	116	78	4E
1	1	1	1	15	SI	17	31	/	57	?	77	63	3F	O	117	79	4F

KEY

ASCII CHARACTER

ESC	33	OCTAL
	27	DECIMAL
	1B	HEX

Table 3-7 Norway/Denmark Character Set

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1			
		COLUMN 0		1		2		3		4		5		6		7			
B4	B3	B2	B1	ROW															
0	0	0	0	NUL	0 0 0		20 16 10	SP	40 32 20	0	60 48 30	Ä	100 64 40	P	120 80 50	ä	140 96 60	p	160 112 70
0	0	0	1	DC1 (XON)	1 1 1	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71	
0	0	1	0		2 2 2	22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72	
0	0	1	1	DC3 (XOFF)	3 3 3	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73	
0	1	0	0		4 4 4	24 20 14	\$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74	
0	1	0	1	ENQ	5 5 5	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75	
0	1	1	0		6 6 6	26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76	
0	1	1	1	BEL	7 7 7	27 23 17	,	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77	
1	0	0	0	BS	10 8 8	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
1	0	0	1	HT	11 9 9	31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
1	0	1	0	LF	12 10 A	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A	
1	0	1	1	VT	13 11 B	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	Æ	133 91 5B	k	153 107 6B	æ	173 123 7B	
1	1	0	0	FF	14 12 C	34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	Ø	134 92 5C	l	154 108 6C	ø	174 124 7C	
1	1	0	1	CR	15 13 D	35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	Å	135 93 5D	m	155 109 6D	å	175 125 7D	
1	1	1	0	SO	16 14 E	36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	Ü	136 94 5E	n	156 110 6E	ü	176 126 7E	
1	1	1	1	SI	17 15 F	37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	—	137 95 5F	o	157 111 6F	DEL	177 127 7F	

KEY

ASCII CHARACTER

ESC	33	OCTAL
[	27	DECIMAL
	1B	HEX

Table 3-8 French Canada Character Set

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
		COLUMN 0		1		2		3		4		5		6		7	
		B4	B3	B2	B1	ROW											
0 0 0 0	0	NUL	0			20	SP	40	0	60	à	100	P	120	ò	140	p
			0			16		32	0	48	á	64		80	ó	96	160
			0			10		20	1	30	é	40		50	ó	60	112
				1	DC1	21	!	41	1	61	A	101	Q	121	a	141	161
				1	(XON)	17		33	1	49	á	65		81	á	97	113
				1		11		21	2	31	é	41		51	é	61	71
			2			22	"	42	2	62	B	102	R	122	b	142	162
			2			18		34	2	50	á	66		82	b	98	114
			2			12		22	3	32	é	42		52	é	62	72
			3	DC3	(XOFF)	23	#	43	3	63	C	103	S	123	c	143	163
			3			19		35	3	51	á	67		83	c	99	115
			3			13		23	3	33	é	43		53	c	63	73
			4			24	\$	44	4	64	D	104	T	124	d	144	164
			4			20		36	4	52	á	68		84	d	100	116
			4			14		24	4	34	é	44		54	d	64	74
		ENQ	5			25	%	45	5	65	E	105	U	125	e	145	165
			5			21		37	5	53	á	69		85	e	101	117
			5			15		25	5	35	é	45		55	e	65	75
			6			26	&	46	6	66	F	106	V	126	f	146	166
			6			22		38	6	54	á	70		86	f	102	118
			6			16		26	6	36	é	46		56	f	66	76
		BEL	7			27	'	47	7	67	G	107	W	127	g	147	167
			7			23		39	7	55	á	71		87	g	103	119
			7			17		27	7	37	é	47		57	g	67	77
		BS	8	CAN	30	(	50	8	70	H	110	X	130	h	150	x	170
			8			24		40	8	56	á	72		88	h	104	120
			8			18		28	8	38	é	48		58	h	68	78
		HT	9			31	)	51	9	71	I	111	Y	131	i	151	y
			9			25		41	9	57	á	73		89	i	105	121
			9			19		29	9	39	é	49		59	i	69	79
		LF	10	SUB	32	*	52	:	10	72	J	112	Z	132	j	152	z
			10			26		42	10	58	á	74		90	j	106	122
			A			1A		2A	10	3A	é	4A		5A	j	6A	7A
		VT	11	ESC	33	+	53	:	11	73	K	113	â	133	k	153	é
			11			27		43	11	59	á	75		91	k	107	123
			B			1B		2B	11	3B	é	4B		5B	k	6B	7B
		FF	12			34	,	54	12	74	L	114	ç	134	l	154	ù
			12			28		44	12	60	á	76		92	l	108	124
			C			1C		2C	12	3C	é	4C		5C	l	6C	7C
		CR	13			35	-	55	13	75	M	115	ê	135	m	155	è
			13			29		45	13	61	á	77		93	m	109	125
			D			1D		2D	13	3D	é	4D		5D	m	6D	7D
		SO	14			36	.	56	14	76	N	116	î	136	n	156	û
			14			30		46	14	62	á	78		94	n	110	126
			E			1E		2E	14	3E	é	4E		5E	n	6E	7E
		SI	15			37	/	57	15	77	O	117	—	137	o	157	DEL
			15			31		47	15	63	á	79		95	o	111	177
			F			1F		2F	15	3F	é	4F		5F	o	6F	127

KEY

ASCII CHARACTER	ESC	33	OCTAL
		27	DECIMAL
		1B	HEX

Table 3-9 Sweden Character Set

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1		
		COLUMN 0		1		2		3		4		5		6		7		
B4	B3	B2	B1	ROW														
0	0	0	0	0	NUL	000		20 16 10	SP	40 32 20	0	60 48 30	É	100 64 40	P	120 80 50	é	140 96 60
0	0	0	1	1	DC1 (XON)	111	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61		
0	0	1	0	2		22 18 12	"	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62		
0	0	1	1	3	DC3 (XOFF)	19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63		
0	1	0	0	4		24 20 14	\$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64		
0	1	0	1	5	ENQ	55		45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65		
0	1	1	0	6		26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66		
0	1	1	1	7	BEL	77	,	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67		
1	0	0	0	8	BS	108	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68
1	0	0	1	9	HT	119		31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69
1	0	1	0	10	LF	1210A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A
1	0	1	1	11	VT	1311B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	Ä	133 91 5B	k	153 107 6B
1	1	0	0	12	FF	1412C		34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	Ö	134 92 5C	l	154 108 6C
1	1	0	1	13	CR	1513D		35 29 1D	-	55 45 2D	=	75 61 3D	M	115 77 4D	Å	135 93 5D	m	155 109 6D
1	1	1	0	14	SO	1614E		36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	Ü	136 94 5E	n	156 110 6E
1	1	1	1	15	SI	1715F		37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	—	137 95 5F	o	157 111 6F
																DEL	177 127 7F	

KEY

ASCII CHARACTER	ESC	33	OCTAL
		27	DECIMAL
		1B	HEX

Table 3-10 VT100 Compatible Character Set

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1				
		COLUMN 0		1		2		3		4		5		6		7				
		B4	B3	B2	B1	ROW														
0 0 0 0	0	NUL	0			20	16	SP	40	32	0	60	@	100	P	120	◆	140	-	160
			0			10			20		48	40		64	80	50	96	60	112	70
0 0 0 1	1		1	DC1	(XON)	21	17	!	41	33	1	61	A	101	Q	121	☒	141	-	161
			1			11			21		49	41		65	81	51	97	61	113	71
0 0 1 0	2		2			22	18	"	42	34	2	62	B	102	R	122	₩	142	-	162
			2			12			22		50	42		66	82	52	98	62	114	72
0 0 1 1	3		3	DC3	(XOFF)	23	19	#	43	35	3	63	C	103	S	123	£	143	-	163
			3			13			23		51	43		67	83	53	99	63	115	73
0 1 0 0	4		4			24	20	\$	44	36	4	64	D	104	T	124	₭	144	-	164
			4			14			24		52	44		68	84	54	100	64	116	74
0 1 0 1	5	ENQ	5			25	21	%	45	37	5	65	E	105	U	125	₭	145	-	165
			5			15			25		53	45		69	85	55	101	65	117	75
0 1 1 0	6		6			26	22	&	46	38	6	66	F	106	V	126	ø	146	└	166
			6			16			26		54	46		70	86	56	102	66	118	76
0 1 1 1	7	BEL	7			27	23	'	47	39	7	67	G	107	W	127	±	147	-	167
			7			17			27		55	47		71	87	57	103	67	119	77
1 0 0 0	8	BS	10	CAN	30	30	(	50	40	8	70	H	110	X	130	₮	150	-	170	
			8			24			28		56	48		72	88	58	104	68	120	78
1 0 0 1	9	HT	11			31	25	)	51	41	9	71	I	111	Y	131	₩	151	-	171
			9			19			29		57	39		73	89	59	105	69	121	79
1 0 1 0	10	LF	12	SUB	32	26	*	52	42	:	72	J	112	Z	132	Ј	152	-	172	
			10			1A			2A		58	3A		74	90	5A	106	6A	122	7A
1 0 1 1	11	VT	13	ESC	33	27	+	53	43	;	73	K	113	[	133	І	153	-	173	
			11			1B			2B		59	3B		75	91	5B	107	6B	123	7B
1 1 0 0	12	FF	14			34	28	,	54	44	<	74	L	114	\	134	Г	154	-	174
			12			1C			2C		60	3C		76	92	5C	108	6C	124	7C
1 1 0 1	13	CR	15			35	29	-	55	45	=	75	M	115	]	135	Л	155	-	175
			13			1D			2D		61	3D		77	93	5D	109	6D	125	7D
1 1 1 0	14	SO	16			36	30	.	56	46	>	76	N	116	^	136	†	156	=	176
			14			1E			2E		62	3E		78	94	5E	110	6E	126	7E
1 1 1 1	15	SI	17			37	31	/	57	47	?	77	O	117	(BLANK)	137	-	157	DEL	177
			15			1F			2F		63	3F		79	95	5F	111	6F	127	7F
																SCAN 1				

KEY

ASCII CHARACTER

ESC	33	OCTAL
	27	DECIMAL
	1B	HEX

Active Column and Active Line – Active column is the column where the next character is printed. Active line is the line where the next character is printed. Column and line numbers begin with one, not zero. Printable characters usually increment the active column. Line feeds, vertical tabs, and form feeds increment the active line.

The active column and active line are collectively known as active position. Active position is only loosely linked to the physical position of the carriage and paper mechanism. Generally, the active column is only recorded when a character is actually printed. Any previous active column values are not significant.

The graphic printer carriage moves .4 inches to the right whenever printing stops for more than one second. This action allows the last character printed to be viewed. However active column is not affected by this feature. Bell characters have only an active line attribute. They are not guaranteed to be sounded at any particular column within a line.

In addition to the control characters (backspace, horizontal tab, carriage return, line feed, vertical tab, and form feed) the following escape sequences modify active column and active line.

Name	Mnemonic	Sequence				Function
Index	IND	ESC D 033 104				Increment active line and advance paper. Line feed new line mode has no effect on this feature

*NOTE: The *** character is used to indicate variable numeric parameters within the octal representation of the control or escape sequence.*

Vertical position absolute	VPA	ESC [	Pn ***	d	Set active line to Pn – if Pn is less than or equal to active line, or is greater than bottom margin, active line is set to top margin on next page
Next line	NEL	ESC E	033 105		Set active column to left margin and increment active line

Name	Mnemonic	Sequence				Function
Horizontal position absolute	HPA	ESC	[	Pn	\	Set active column to column Pn – if Pn is greater than right margin, active column is set to left margin on next line – if Pn is less than or equal to left margin, active column is set to left margin
Horizontal position relative	HPR	ESC	[	Pn	a	Advance current active column by Pn columns – if active column exceeds right margin, active column is set to left margin on next line regardless of actual value of Pn – if Pn = 0, then no motion occurs
Cursor up	CUU	ESC	[	Pn	A	Decrement current active line by Pn lines without going past top margin – if Pn is greater than or equal to current active line, sequence is ignored
Vertical position relative	VPR	ESC	[	Pn	e	Advance active line by Pn lines – if Pn = 0, 256 lines is assumed – if parameter exceeds bottom margin, active
		033	133	***	145	

Name	Mnemonic	Sequence	Function
			line is set to top margin on next page regardless of actual value of Pn

NOTE: The PLD sequence does not modify active line. To avoid losing the top of form reference, send an equal number of PLU sequences to the printer.

Partial line down	PLD	ESC 033	K 113	Index paper down .212 cm (1/12 inch)-line feed new line mode has no effect on this sequence
-------------------	-----	---------	-------	---

NOTE: The PLU sequence does not modify active line. To avoid losing the top of form reference, send an equal number of PLD sequences to the printer.

Partial line up	PLU	ESC 033	L 114	Index paper up .212 cm (1/12 inch)-line feed new line mode has no effect on this sequence
-----------------	-----	---------	-------	---

Reverse index	RI	ESC 033	M 115	Decrement active line and move paper up one line-line feed new line mode has no effect on this sequence
---------------	----	---------	-------	---

Horizontal Pitch (Characters Per Inch) – Horizontal pitch determines the width of printed characters as well as their spacing. The graphic printer has eight horizontal pitch selections (Figure 3-3). Any combinations of pitch may be used on a single print line.

Changing the horizontal pitch modifies the active column. The modified new active column is the first column boundary at or to the right of the physical position of the previous active column in the old pitch. New active column is calculated in the following way.

Characters Per Inch	Example
16.5	!#\$%&'()*+,-./0123456789::<=>?@ABCDEFGHIJKLMNPQRSTUVWXYZ[\\]^_
13.2	!#\$%&'()*+,-./0123456789::<=>?@ABCDEFGHIJKLMNPQRS
12.0	!#\$%&'()*+,-./0123456789::<=>?@ABCDEFGHIJKLMN
10.0	!#\$%&'()*+,-./0123456789::<=>?@ABCDEFI
8.25	!#\$%&'()*+,-./0123456789::<=>?E
6.6	!#\$%&'()*+,-./0123456789
6.0	!#\$%&'()*+,-./01234567
5.0	!#\$%&'()*+,-./0123

Figure 3-3 Horizontal Pitch Examples

$$\text{New column} = 1 + \frac{(\text{Old column} - 1) \times \text{Oldpitch}}{\text{New pitch}}$$

where New column = the new active column
 New pitch = the new pitch in inches per character
 Old column = the old active column
 Old pitch = the old pitch in inches per character

The division performed above is an integer division. Any remainder or fractional part of the quotient is discarded.

Changing horizontal pitch also clears horizontal margins. The left margin is set to column one and the right margin is set to the maximum column for the selected pitch (Table 3-11).

Table 3-11 Maximum Right Margins

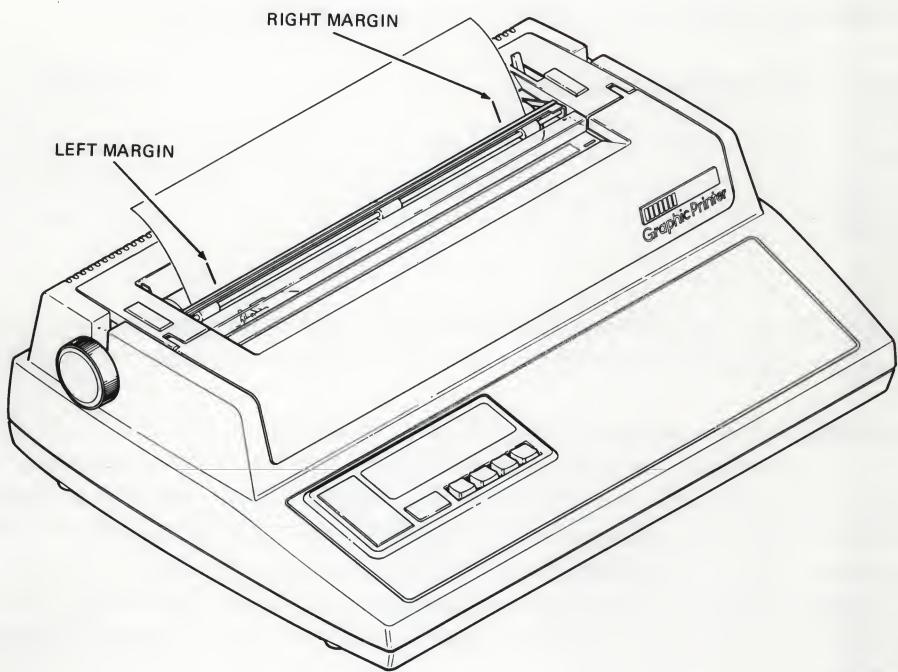
Horizontal Pitch	Maximum Right Margin
10	132
12	158
13.2	168
16.5	216
5	66
6	79
6.6	84
8.25	108

The horizontal pitch power up default selection is 10 characters per inch (char/in). The following sequences are used to set horizontal pitch.

Name	Mnemonic	Sequence				Function
Set horizontal pitch	DEC\$HORP	ESC	[	0	w	Set horizontal pitch to 10 char/in
		033	133	060	167	
		ESC	[	1	w	Set horizontal pitch to 10 char/in
		033	133	061	167	
		ESC	[	2	w	Set horizontal pitch to 12 char/in
		033	133	062	167	
		ESC	[	3	w	Set horizontal pitch to 13.2 char/in
		033	133	063	167	
		ESC	[	4	w	Set horizontal pitch to 16.5 char/in
		033	133	064	167	
		ESC	[	5	w	Set horizontal pitch to 5 char/in
		033	133	065	167	
		ESC	[	6	w	Set horizontal pitch to 6 char/in
		033	133	066	167	
		ESC	[	7	w	Set horizontal pitch to 6.6 char/in
		033	133	066	167	
		ESC	[	8	w	Set horizontal pitch to 8.25 char/in
		033	133	070	167	

Horizontal Margins – The left horizontal margin specifies the first printable column on a line; the right horizontal margin specifies the last printable column on a line. Printing is permitted only within the left and right margins inclusive (Figure 3-4).

The set horizontal margins sequence when accompanied by two parameters, sets the left and right margins. If both parameters are not zero, and the first is the smaller of the two, the left margin is set to the first specified parameter and the right is set to the second. The carriage is then repositioned to the new left margin.



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Figure 3-4 Horizontal Margins

NOTE: Changing the horizontal pitch modifies the horizontal margins. The left margin is set to column one and the right margin is set to the maximum right margin in the selected horizontal pitch (Table 3-11).

The sequence is ignored if the first parameter is greater than or equal to the second parameter. The sequence is also ignored if one of the specified parameters would set the right margin further right than 13.2 inches.

If the first parameter in the sequence is omitted, the remaining parameter sets the right margin to the specified value. If an attempt is made to set the right margin to the left of the left margin, the sequence is ignored.

If the second parameter in the sequence is omitted, the first parameter sets the left margin to the specified value. If an attempt is made to set the left margin to the right of the right margin, the sequence is ignored. If the active column is less than the new left margin, it is set to the new left margin and the carriage is repositioned.

If both parameters are zero or omitted, the margins are unchanged. The power-up default setting for the left margin is column one. The power-up default setting for the right margin is column 132.

The following sequence is used to set the left and right margins.

Name	Mnemonic	Sequence	Function
Set left and right margins	DECSLRM	ESC [Pn ; Pn s 033 133 *** 073 *** 163	Set left and right margins to the values given

*NOTE: The *** character is used to indicate variable numeric parameters within the octal representation of the control or escape sequence.*

Horizontal Tabs – A horizontal tab is a preselected point on a line to which the printhead advances when a horizontal tab control character is received (Figure 3-5). The DECwriter IV Graphic Printer has 216 possible horizontal tab stops, one for each column. Tab stops are associated with column numbers, not physical positions on the paper. Therefore, changing horizontal pitch also changes the physical position of tab stops. Each stop may be set or cleared independently. Setting a stop already set has no effect; the same is true for clearing a stop already cleared. Tab stops may be set or cleared regardless of margins or horizontal pitch. The power-up default settings for horizontal tabs are one every nine columns.

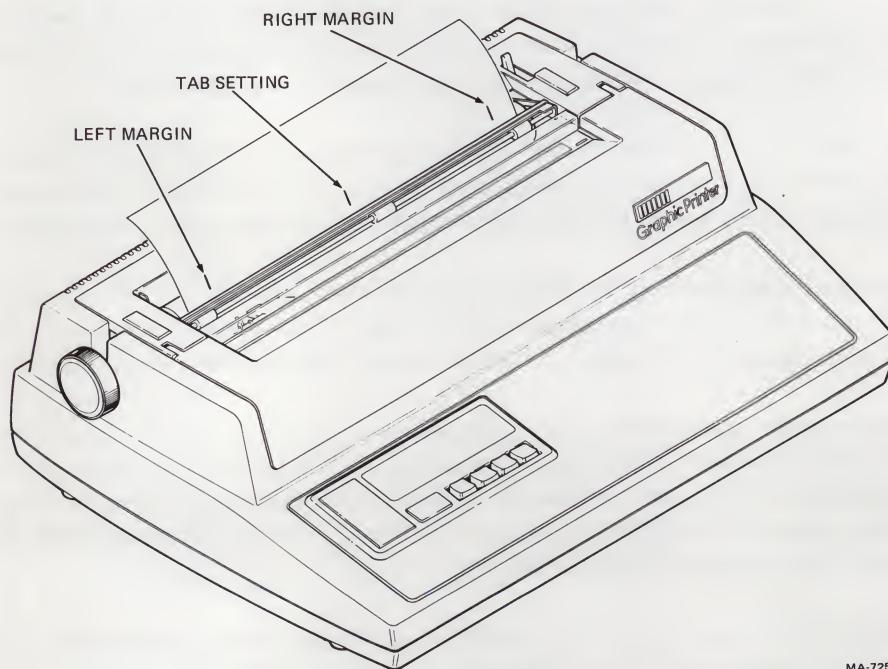


Figure 3-5 Horizontal Tab Stop

The following sequences are used to set or clear horizontal tab stops.

Name	Mnemonic	Sequence	Function
Horizontal tabulation set	HTS	ESC H 033 110	Set horizontal tab stop at active column
Horizontal tabulation set	DECHTS	ESC 1 033 061	Set horizontal tab stop at active column
Tabulation clear	TBC	ESC [0 g 033 133 060 147	Clear horizontal tab at active column
Tabulation clear	TBC	ESC [2 g 033 133 062 147	Clear all horizontal tab stops
Tabulation clear	TBC	ESC [3 g 033 133 063 147	Clear all horizontal tab stops
Clear all horizontal tabs	DECCAHT	ESC 2 033 062	Clear all horizontal tab stops

*NOTE: The *** character is used to indicate variable numeric parameters within the octal representation of the control or escape sequence.*

Set horizontal tabs	DECSHTS	ESC [Pn ; ... Pn u 033 133 *** 073 ... *** 165	Set horizontal tab stops at the given values
---------------------	---------	--	--

2	3	4	6	8	12
! "#\$%& /	! "#\$%& /	! "#\$%& /	! "#\$%& /	! "#\$%& /	! "#\$%& /
! "#\$%& /	! "#\$%& /	! "#\$%& /	! "#\$%& /	! "#\$%& /	! "#\$%& /
! "#\$%& /	! "#\$%& /	! "#\$%& /	! "#\$%& /	! "#\$%& /	! "#\$%& /

Figure 3-6 Vertical Pitch Examples

Vertical Pitch (Lines Per Inch) – Vertical pitch determines the spacing between lines, not the height of printed characters (Figure 3-6). The DECwriter IV Graphic Printer has six vertical pitch selections. Changing vertical pitch does the following things.

- Changes form length
- Resets the top margin and active line to line one
- Resets the bottom margin to the line equal to the form length (Table 3-12)

Table 3-12 Form Length (Lines Per Form)

Form Length in Inches	Vertical Pitch Selected					
	2	3	4	6	8	12
3	6	9	12	18	24	36
3.5	7	*	14	21	28	42
4	8	12	16	24	32	48
5.5	11	*	22	33	44	66
6	12	18	24	36	48	72
7	14	21	28	42	56	84
8	16	24	32	48	64	96
8.5	17	*	34	51	68	102
11	22	33	44	66†	88	132
12	24	36	48	72	96	144
14	28	42	56	84	112	168

*Not recommended

†11 inch form at 6 lines per inch equals 66 line form length

Changing vertical pitch in the middle of a page causes the top of form reference to be lost.

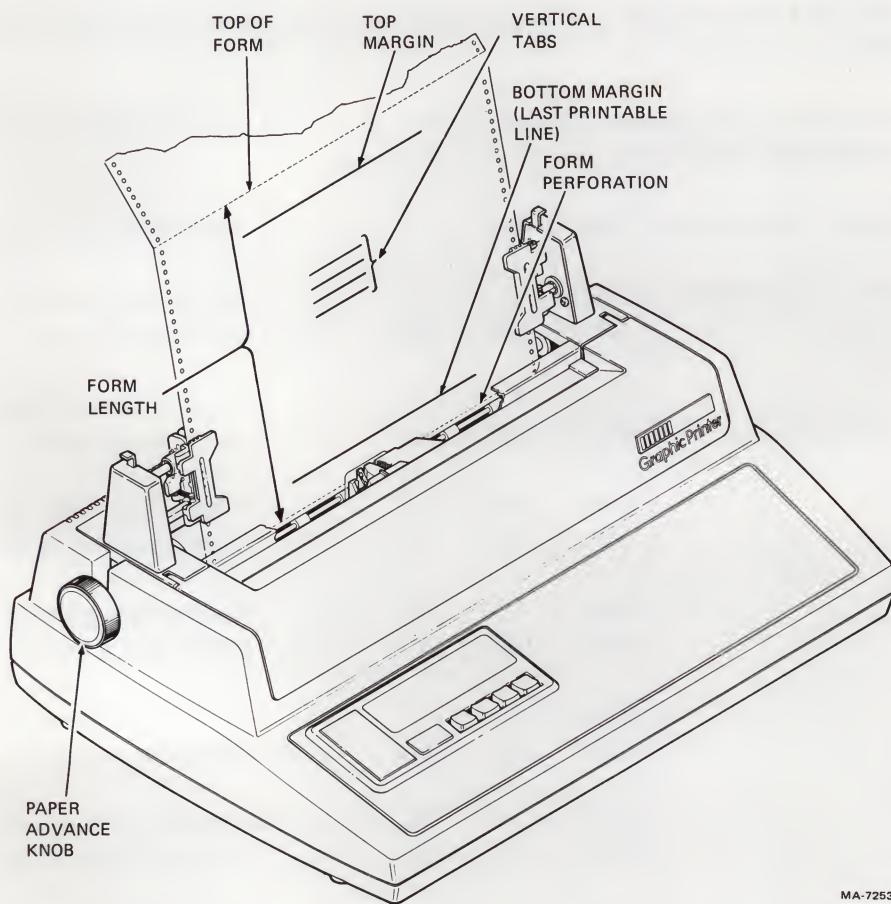
The vertical pitch power up default selection is six lines per inch. The following sequences are used to set vertical pitch.

Name	Mnemonic	Sequence				Function
Set vertical pitch	DECVERP	ESC	[	0	z	Set vertical pitch to six lines per inch
		033	133	060	172	
		ESC	[	1	z	Set vertical pitch to six lines per inch
		033	133	061	172	
		ESC	[	2	z	Set vertical pitch to eight lines per inch
		033	133	062	172	
		ESC	[	3	z	Set vertical pitch to twelve lines per inch
		033	133	063	172	
		ESC	[	4	z	Set vertical pitch to two lines per inch
		033	133	064	172	
		ESC	[	5	z	Set vertical pitch to three lines per inch
		033	133	065	172	
		ESC	[	6	z	Set vertical pitch to four lines per inch
		033	133	066	172	

Form Length – Form length is measured in lines per form. To determine lines per form, measure the form length in inches. Then, multiply the result by the current vertical pitch. Changing vertical pitch also alters the physical form length (Table 3-6). Forms may be from 1 to 168 lines in length. Changing form length resets the top margin and active line to line one, and the bottom margin to the line equal to the form length. The power-up default form length selection is 66 lines. The following sequence sets form length.

*NOTE: The *** character is used to indicate variable numeric parameters within the octal representation of the control or escape sequence.*

Name	Mnemonic	Sequence				Function
Set lines per physical page	DECSLPP	ESC	[Pn	t	Set form length to n lines, set top margin and active line to line one, set bottom margin to line n
		033	133	***	164	



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Figure 3-7 Vertical Margins and Tabs

Vertical Margins – The top vertical margin specifies the first printable line; the bottom vertical margin specifies the last printable line. Printing is allowed only on the lines between the top and bottom margins inclusive (Figure 3-7).

When vertical pitch and form length are changed, vertical margins are cleared; the top margin is set to line one and the bottom margin is set to the form length. The following conditions must exist to set new vertical margins.

- Top margin must be greater than or equal to one
- Bottom margin must be greater than or equal to the top margin
- Form length must be greater than or equal to the bottom margin

Attempting to print above the top margin or below the bottom margin automatically advances the active line to the top margin of the next page. For example, a line feed (LF) received at the bottom margin causes the graphic printer to perform a form feed.

The set vertical margins sequence, accompanied by two parameters, set the top and bottom margins. If both parameters are not zero and the first is the smaller of the two, the top margin is set to the first parameter and the bottom is set to the second. Then the carriage may be repositioned to the new top margin depending on the current line position and printer activity.

The sequence is ignored if the first parameter is greater than or equal to the second parameter. The sequence is also ignored if one of the specified parameters would set the bottom margin past the assigned form length.

If the first parameter in the sequence is omitted, the remaining parameter sets the bottom margin to the specified line. If an attempt is made to set the bottom margin above the top margin, the sequence is ignored.

If the second parameter in the sequence is omitted, the first parameter sets the top margin to the specified line. If an attempt is made to set the top margin below the bottom margin, the sequence is ignored. If the active line is less than the new top margin, it is set to the new top margin and the carriage is repositioned.

If both parameters are set to zero or omitted the margins are unchanged. The power-up default top margin selection is line one. The power-up default selection for the bottom margin is line 66.

The following sequences set the top and bottom margins.

Name	Mnemonic	Sequence	Function
Set top, bottom margins	DECSTBM	ESC [Pn ; Pn r 033 133 *** 073 *** 162	Set top margin to line Pn and bottom margin to line Pn

*NOTE: The *** character is used to indicate variable numeric parameters within the octal representation of the control or escape sequence.*

Vertical Tabs – A vertical tab is a preselected line to which the printhead advances when a vertical tab control character is received (Figure 3-7). The graphic printer has 168 vertical tab positions. Vertical tabs may be set and cleared like horizontal tabs. Vertical tab stops are associated with specific line numbers, not physical positions on the paper. Therefore, changing vertical pitch changes the printing position of vertical tabs on the paper. The power up default settings for vertical tabs are on every line. The following sequences set or clear vertical tab stops.

Name	Mnemonic	Sequence	Function
Vertical tab set	VTS	ESC J 033 112	Set vertical tab stop at active line
Vertical tab set	DECVTS	ESC 3 033 063	Same

*NOTE: The *** character is used to indicate variable numeric parameters within the octal representation of the control or escape sequence.*

Name	Mnemonic	Sequence	Function
Set vertical tab stops	DECSVTS	ESC [Pn ; ... Pn v 033 133 *** 073 *** 166	Set vertical tab stops at lines given
Tabulation clear	TBC	ESC [1 g 033 133 061 147	Clear vertical tab stops at active line
Tabulation clear	TBC	ESC [4 g 033 133 064 147	Clear all vertical tab stops
Clear all vertical tabs	DECCAVT	ESC 4 033 064	Same

Product Identification – The DECwriter IV Graphic Printer automatically transmits an answer to the ANSI standard request for device attributes. The following sequences cause the graphic printer to transmit its product identification sequence.

Name	Mnemonic	Sequence	Function
Device attributes	DA	ESC [c 033 133 143	Transmits ESC [? 3 ; 7 c which forms the product identification of the basic DECwriter IV Graphic Printer.

Name	Mnemonic	Sequence				Function
Device attributes	DA	ESC 033	[133	0 060	c 143	Same
Identify terminal	DECID	ESC 033	Z 132			Same

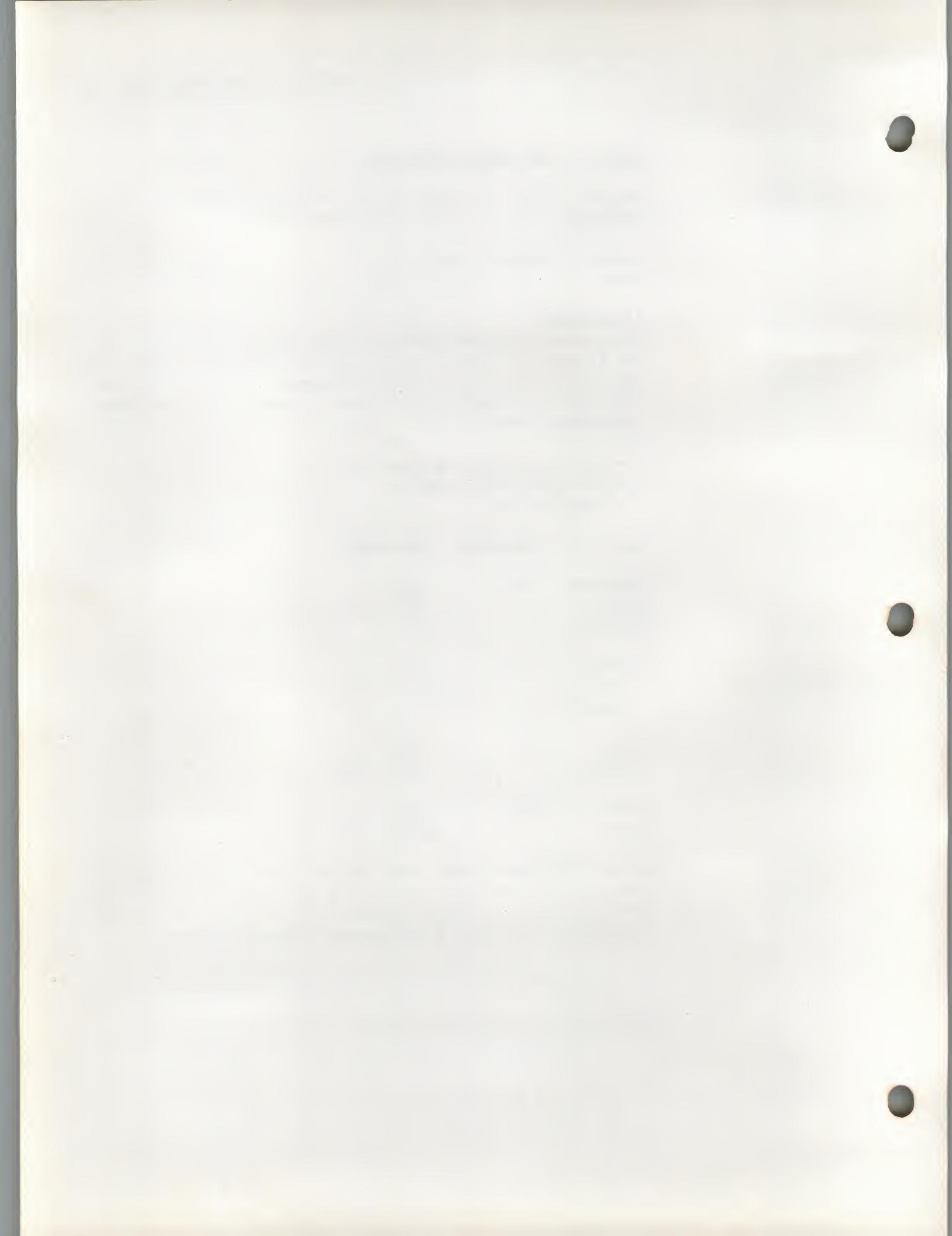
ANSI Strings

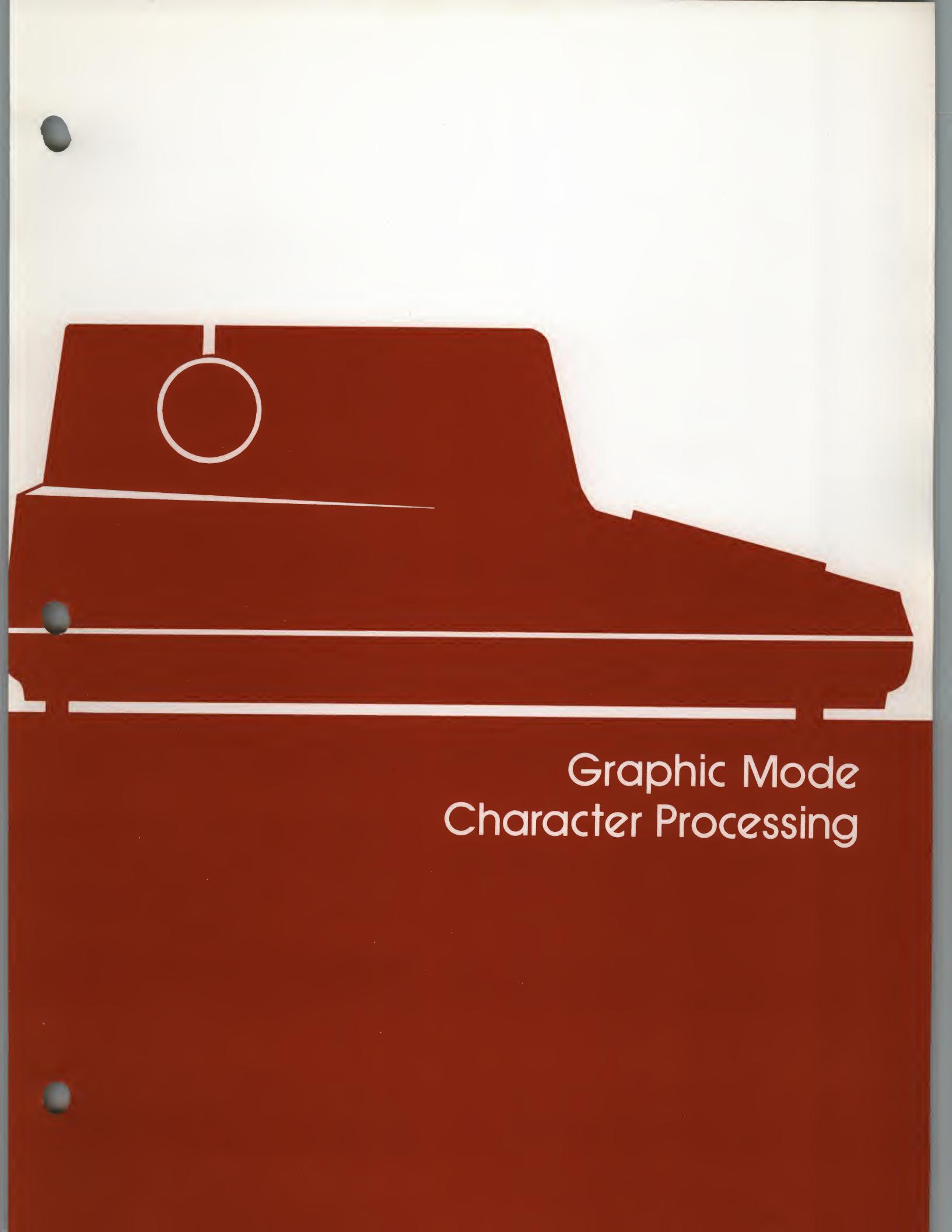
When the graphic printer receives any of the escape sequences listed below, it responds as usual to control characters received (octal 000 - 037 and 177) and discards any printable characters received (octal 040 - 176). The printer reverts to text processing mode when one of the following conditions occur.

- ESC \ (octal 033 134) is received
- CAN, SUB, or ESC is received
- An error occurs

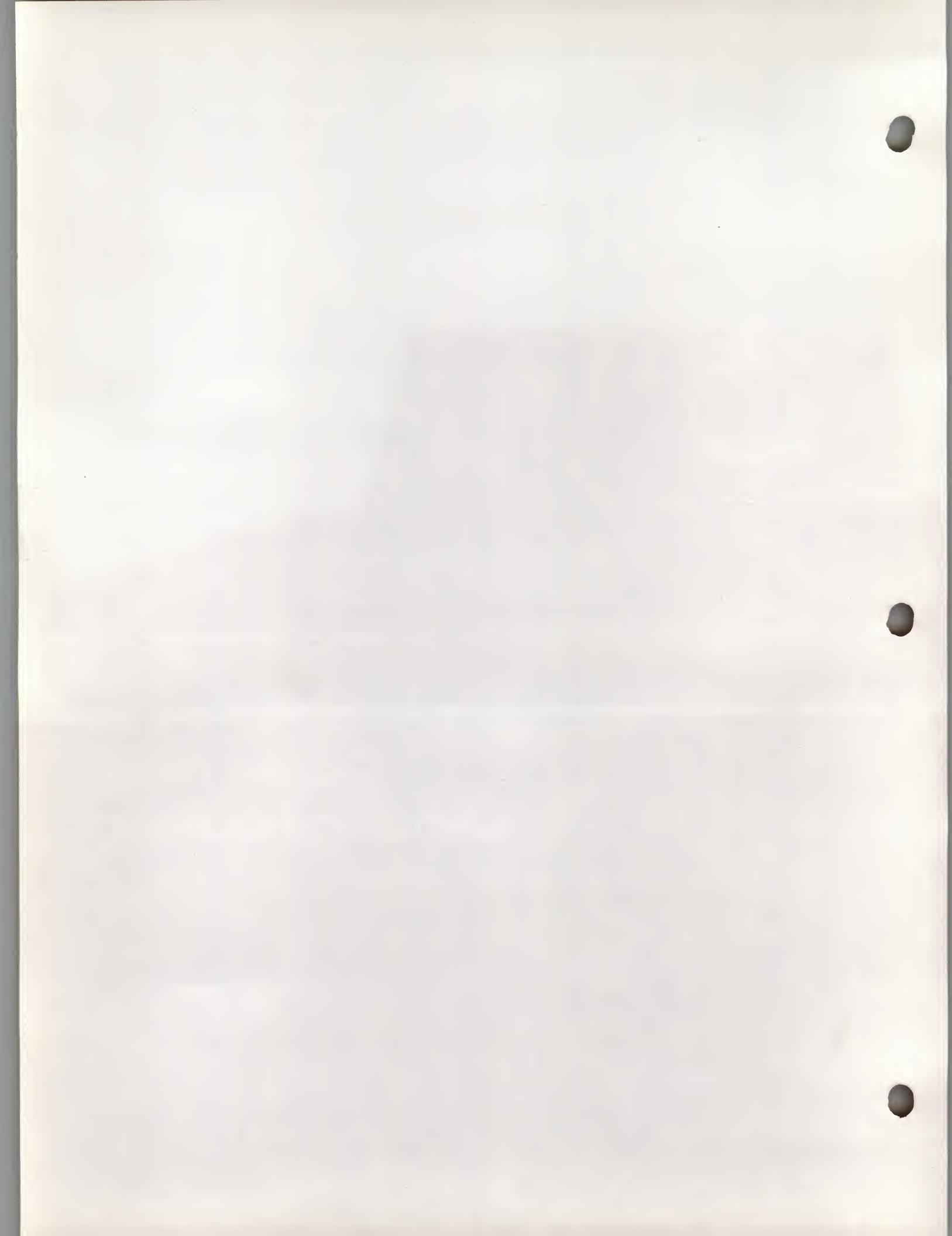
Name	Mnemonic	Sequence	
Application program command	APC	ESC 033	— 137
Operating system command	OSC	ESC 033	] 135
Privacy message	PM	ESC 033	• 136
Device control	DCS	ESC 033	P 120

NOTE: DCS is not graphic mode. The DECwriter IV Graphic Printer remains in DCS mode until it recognizes a valid protocol selector, or the printer receives the terminator sequence ESC . For more detail on DCS mode refer to the Graphic Mode Character Processing chapter.





Graphic Mode Character Processing



4

GRAPHIC MODE CHARACTER PROCESSING

GENERAL

The DECwriter IV Graphic Printer's response to received characters depends on the printing mode selected. There are two basic printing modes; text mode and graphic mode. This chapter describes the graphic printer response to characters received while the printer is in graphic mode.

GRAPHIC MODE

While in text mode, characters are printed as they are received. In graphic mode, characters received define specific columns of dots to be printed. Graphic mode allows users to print dot combinations anywhere on a page. This mode can be used to draw pictures and plot graphs (Figures 4-1 and 4-2).

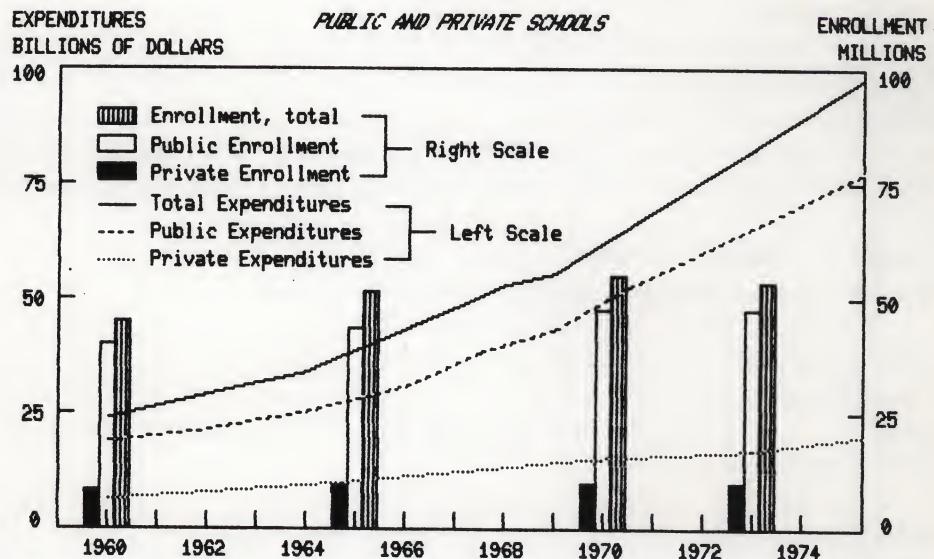


Figure 4-1 Graph Example

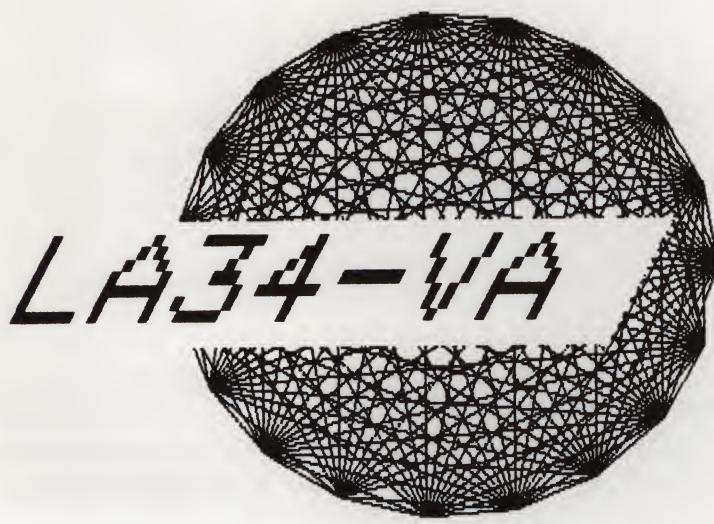


Figure 4-2 Picture Example

After entering graphic mode, both the horizontal and vertical pitch change. The right, left, and bottom margins also change. The graphic mode pitch and margins section describes these changes. DIGITAL does not recommend using single sheet or tractor feed paper when operating in graphic mode.

The graphic printer has a horizontal resolution of 132 columns per inch with a 50 percent overlap, and a vertical resolution of 72 dots per inch with no overlap between dots. There is a 44 percent dot overlap between lines. The aspect ratio (ratio of horizontal to vertical resolution) is 1.83.

GRAPHIC STRING FORMAT

The format for a string of graphic data is as follows.

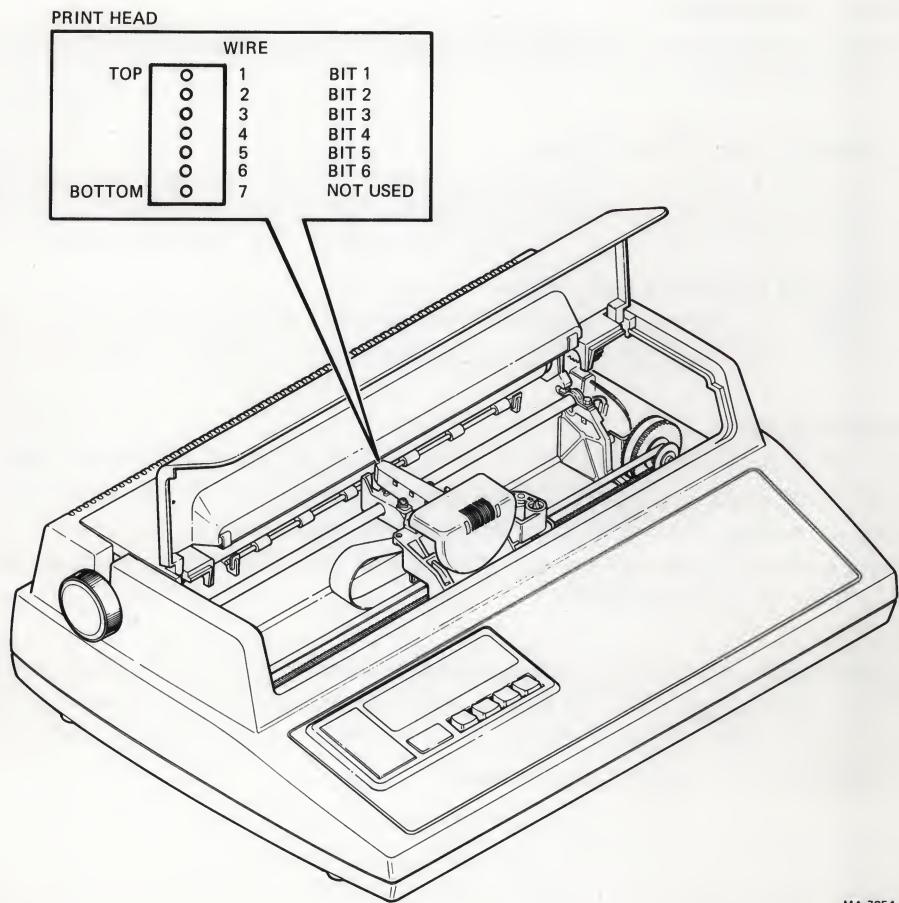
DCS introducer	ESC P
Protocol selector	Pn q
Data	Control characters or column definitions
DCS terminator	ESC \

DCS Introducer

When the graphic printer receives the DCS introducer, it enters DCS mode and waits for the correct protocol selector. The DCS introducer is the ANSI DCS introducer sequence ESC P (octal 033 120).

When the protocol selector is received the graphic printer begins to process data as described in the data section.

The graphic printer remains in DCS mode if the proper protocol selector is not received, or if the graphic printer receives a character that is out of range before the correct protocol selector is recognized.



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Figure 4-3 Graphic Mode Printhead Firing

NOTE: In DCS mode the DECwriter IV Graphic Printer discards all printable characters in the octal range 040 – 176 (Figure 4-3). All control characters received (octal 000 – 037) except CAN (cancel), SUB (substitute), and ESC (escape) are processed as described in the Text Mode Character Processing chapter.

Protocol Selector

After receiving the DCS introducer, the protocol selector causes the graphic printer to enter graphic mode. The protocol selector for the graphic printer consists of a numeric parameter and a final character. The correct protocol is zero (octal 060) or one (octal 061) and q (octal 161).

Data

The data contained within a graphic string can either be control characters or printable data. The following paragraphs describe the control characters to which the graphic printer responds in graphic mode, and the format of the printable characters received.

Control Characters

In graphic mode, the graphic printer responds to a subset of the following control characters.

- **ANSI Control Characters**

Table 4-1 lists and describes the ANSI control characters in the 000 to 037 octal range that are processed in graphic mode.

- **Private Control Characters**

Table 4-2 lists and describes the private control characters in the 040 - 076 octal range that are processed in graphic mode.

Printable Data

After the proper protocol selector is received, any character received in the 077 - 176 octal range is considered printable data. These characters define a column of six dots to be printed. This allows selective firing of the top six printhead wires (Figure 4-3). The bottom or seventh printhead wire is not used in graphic mode.

Printable characters are processed in the following way. The offset (octal 077) is subtracted from the binary value of the character received. The result is a six dot column definition. A printhead wire is fired, and a dot printed, if the corresponding bit is set to one.

Table 4-1 Graphic Mode ANSI Control Characters

Name	Mnemonic	Octal Code	Function
Null	NUL	000	No operation (not stored in the input buffer) – used as fill characters (refer to Communication chapter)
Bell	BEL	007	Sounds audible bell tone
Cancel	CAN	030	Immediately causes an exit graphic mode
Substitute	SUB	032	Replaces any character received with errors – when received in graphic mode, SUB is processed as a one column space
Escape	ESC	033	Causes the DECwriter IV Graphic Printer to exit graphic mode and process the sequence

Table 4-2 Graphic Mode Private Control Characters

Name	Mnemonic	Octal Code	ASCII Character	Function
Graphic repeat introducer	DECGRI	041	!	Begin processing a repeat sequence
Graphic carriage return	DECGCR	044	\$	The collected column definitions are printed, then carriage moves back to position where first character was printed after entering graphic mode, this allows lines to be over printed
Graphic new line	DECGNL	055	-	The collected column definitions are printed and carriage moves back to first character printed after entering graphic mode, then paper is advanced 1 / 12 inch this allows printing of two consecutive lines of graphic data at the same horizontal position

The least significant bit is associated with the top printhead wire (wire one). The sixth bit is associated with the second printhead wire from the bottom (wire six), and is the last wire that can be fired in graphic mode.

Wire	Bit
Top 1	1
2	2
3	3
4	4
5	5
6	6
Bottom 7	Not used

Table 4-3 Printable Character Examples

Character	Octal Value	Binary Value (Minus Offset)	Wires Fired
?	077	00000000	o o o o o o
@	100	00000001	• o o o o o
~	176	00111111	• • • • • • •
-	137	00100000	o o o o o •

Refer to Table 4-3 for several printable character examples. Appendix C contains a complete list of the printable characters and the corresponding dot columns. A printing action does not occur each time a dot column is received. The dot columns are printed when one of the following conditions occur:

- Fourteen columns are received
- A paper motion command is received
- An exit graphic mode sequence is received

Repeat Sequence

A repeat sequence allows the graphic printer to continually print a dot column for a specified number. It has the same effect as receiving the dot column that many times. A repeat sequence is defined as follows.

Repeat introducer ! (octal 041)

Numeric parameter Number of times to print the dot column

Dot column Character in the 077 - 176 octal range

The repeat sequence introducer is the private control character ! (octal 041).

The numeric parameter specifies the number of times to print the column definition that follows. The numeric parameter is a string of characters in the 060 - 071 octal range. If a numeric parameter is not specified, a value of zero is assumed for the numeric parameter. If the value specified is larger than the graphic printer limit for numeric parameters (65,535), the limit is assumed. All decimal digits are processed as part of the count.

The dot column (a character in the 077 - 176 octal range) is printed as many times as specified by the numeric parameter count. All control characters received during a repeat sequence are processed as usual. For example, the control character ! resets the repeat sequence count.

All unspecified characters (octal 072 - 076) are ignored.

If a repeat sequence with 14 or more blank column definitions is received, the graphic printer performs a graphic mode slew. During this condition, the printer moves the carriage assembly over the white space at 45 inches per second. The slew stops for the last 14 columns.

DCS Terminator

The DCS terminator ESC \ (octal 033 134) causes the graphic printer to exit graphic mode and revert to text mode character processing. The CAN (cancel) or ESC (escape) control characters also cause the graphic printer to exit graphic mode. If the ESC control character is received, the graphic printer exits graphic mode and processes the escape sequence.

After an exit condition, the graphic printer is set to the following conditions.

- Text mode features (margins, pitch) are restored.
- Vertical position is modified according to the control characters received while in graphic mode.
- Horizontal position is the same as just before entering graphic mode.
- The first text mode vertical motion command causes the graphic printer to advance to the next text mode line before executing the command (refer to vertical resynchronization).

GRAPHIC MODE PITCH

In graphic mode the horizontal pitch is set to 70 columns per inch (5 characters per inch). The vertical pitch is set to 1/12 lines per inch.

GRAPHIC MODE MARGINS

If an attempt is made to print past the right margin set in text mode, the printer automatically generates a graphic new line (refer to the Private Control Character section in this chapter).

Graphic mode maximum line length depends on the horizontal pitch and right margin selected in text mode. In graphic mode, the maximum line length is 13.1 inches (1,736 dots). To use the maximum line length, the following conditions must be met before entering graphic mode.

- Horizontal pitch feature must be set to 10 characters per inch.
- Text mode left margin must be set to column one.
- Text mode right margin must be set to column 132.
- Active column must be column one

After entering graphic mode the left margin is repositioned to the right (.11 inches maximum) of the last printed column in text mode. Graphic mode left margin is calculated in the following way.

$$\text{Left Margin} = 1 + \frac{(\text{Current Active Column} - 1) \times \text{Old Pitch}}{70}$$

If there is a remainder, round up to the next whole number.

After entering graphic mode the right margin is repositioned to the left of the text mode right margin (.11 inches maximum). The graphic mode right margin is calculated in the following way.

$$\text{Right Margin} = \frac{\text{Old Right Margin} \times \text{Old Pitch}}{70}$$

Discard any remainder.

The top margin remains the same as in text mode. The bottom margin is calculated in the following way.

$$\text{Bottom Margin} = \frac{\text{Old Bottom Margin} \times \text{Old Pitch}}{1 / 12}$$

Perforation Skip

When using perforated paper in graphic mode, it may not be desirable to print on the perforations between sheets of paper. If you are using friction feed roll paper, continuous printing is allowed.

The printer distinguishes between a perforated form and a continuous form in the following way.

- If the top margin equals one and the bottom margin equals the form length, the printer ignores the bottom margin and continues to print data (continuous form).

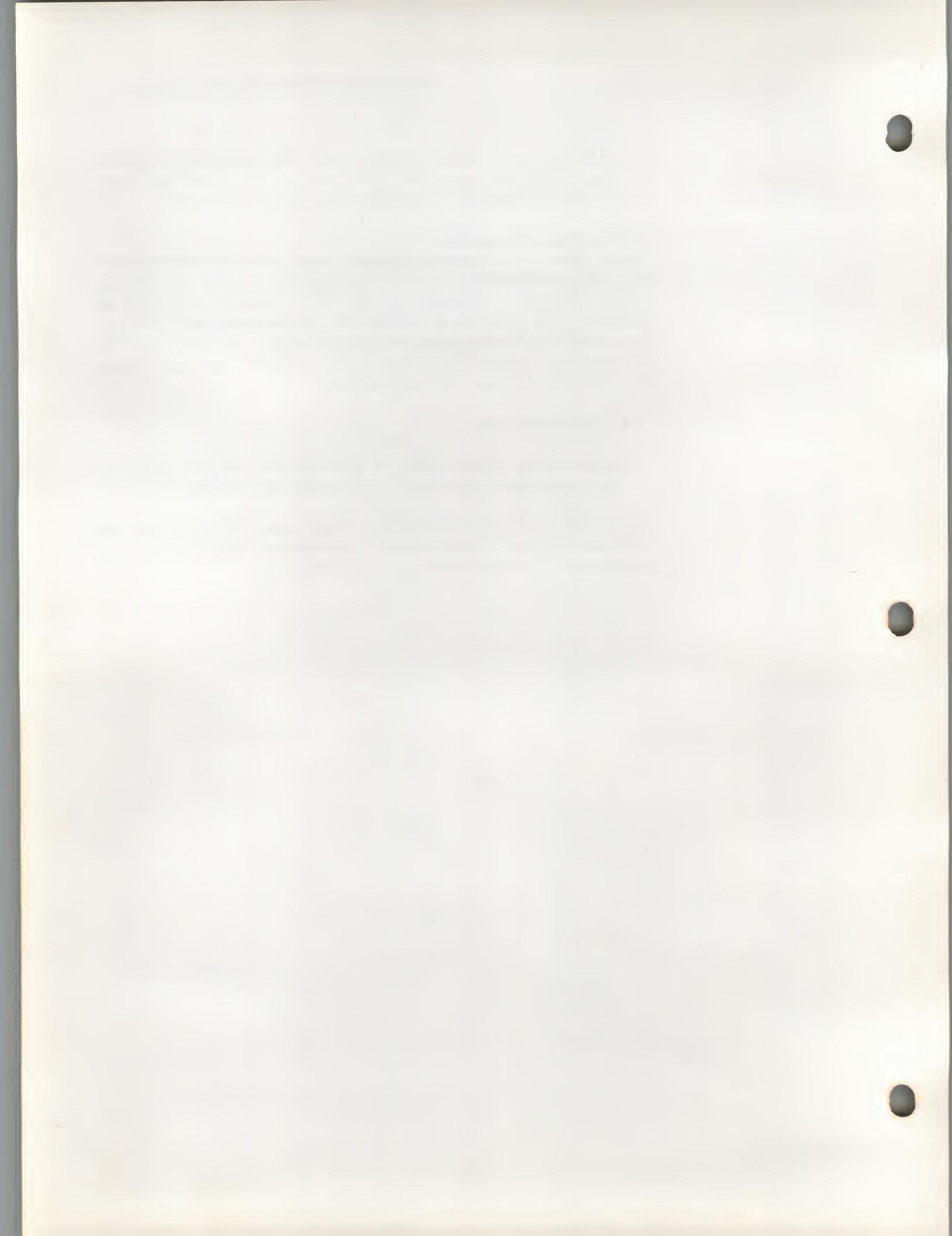
- If the top margin does not equal one or the bottom margin does not equal the form length, the printer does not print below the bottom margin and skips to the next top margin (perforated form).

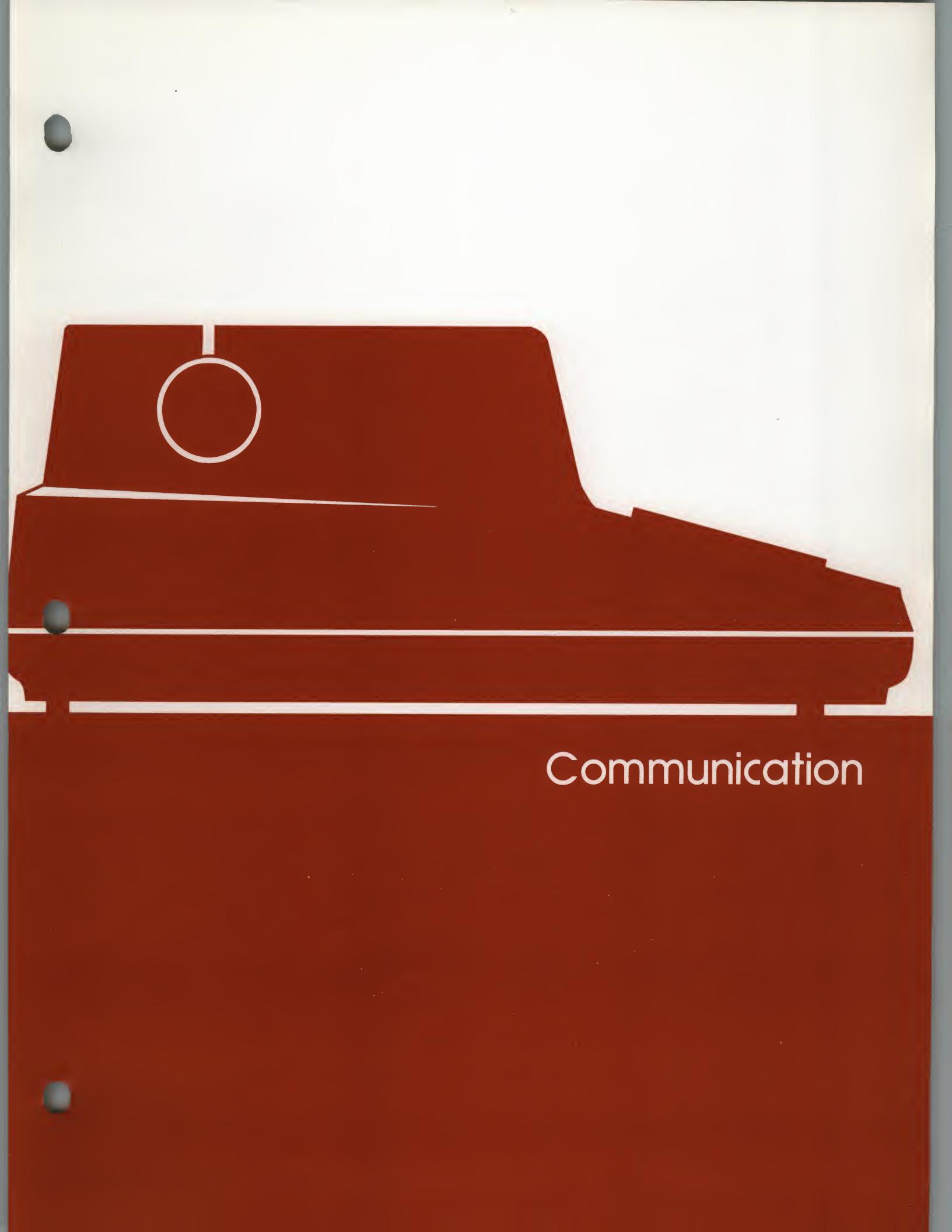
Vertical Resynchronization

In text mode lines are spaced according to the vertical pitch selected (refer to the Vertical Pitch section in Text Mode Character Processing chapter for a description). In graphic mode lines are spaced 1/12 inch apart. Because of the difference in vertical pitch, the printhead may not be on a text mode line when the printer exits graphic mode. The printer must resynchronize the printhead to the next text mode line. This resynchronization occurs during the following conditions.

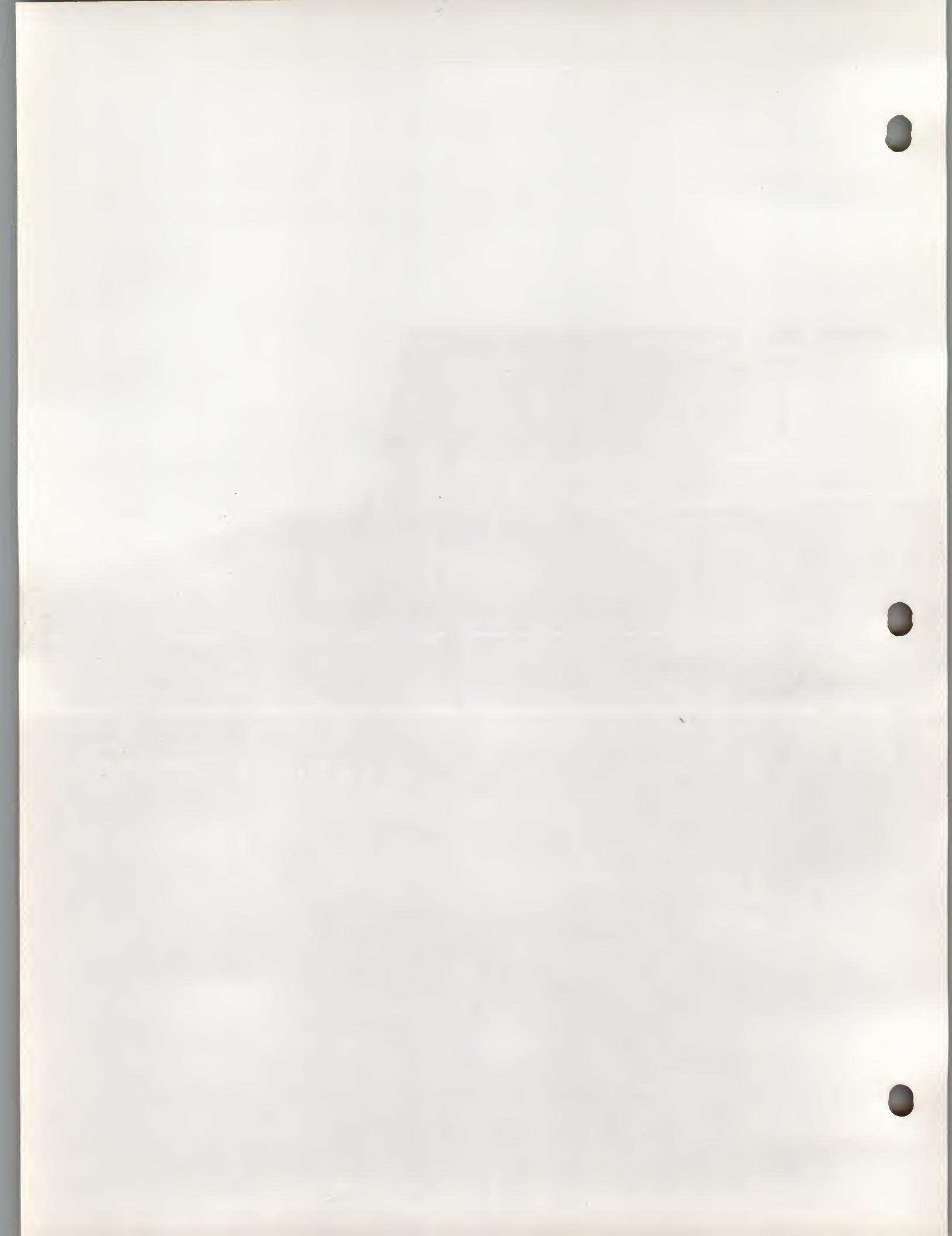
- A perforation skip
- After exiting graphic mode, just before the first vertical motion such as a form feed or line feed (except superscript and subscript)

Superscript or subscript can be used to label graphic data with text mode comments. Reverse line feed is not recommended because the vertical registration of graphic data may not be satisfactory.





Communication



COMMUNICATION

5

GENERAL

This chapter describes the DECwriter IV Graphic Printer communication interfaces and the communication features available to configure the graphic printer to operate with specific computers. This chapter also discusses the methods of controlling data received by the printer to avoid input buffer overflows.

EIA INTERFACE INFORMATION

The graphic printer operates on full-duplex, asynchronous communication lines. The EIA interface connector is a DB-25 male 25 pin connector mounted on the back of the cabinet (Figure 5-1). The DECwriter IV Graphic Printer EIA interface signals meet the EIA specification requirements RS-232-C and the International Telephone and Telegraph Consulting Committee (CCITT) recommendation V.24.

NOTE: The 20 mA current loop interface option allows the printer to be connected directly to a computer up to 305 m (1000 ft) away without the use of a modem (refer to the Options chapter for more detail).

Table 5-1 summarizes the EIA connector signals and the following paragraphs explain each signal as used in the graphic printer. The Communication Feature section explains the effect that the modem/no modem feature has on the EIA control signals.

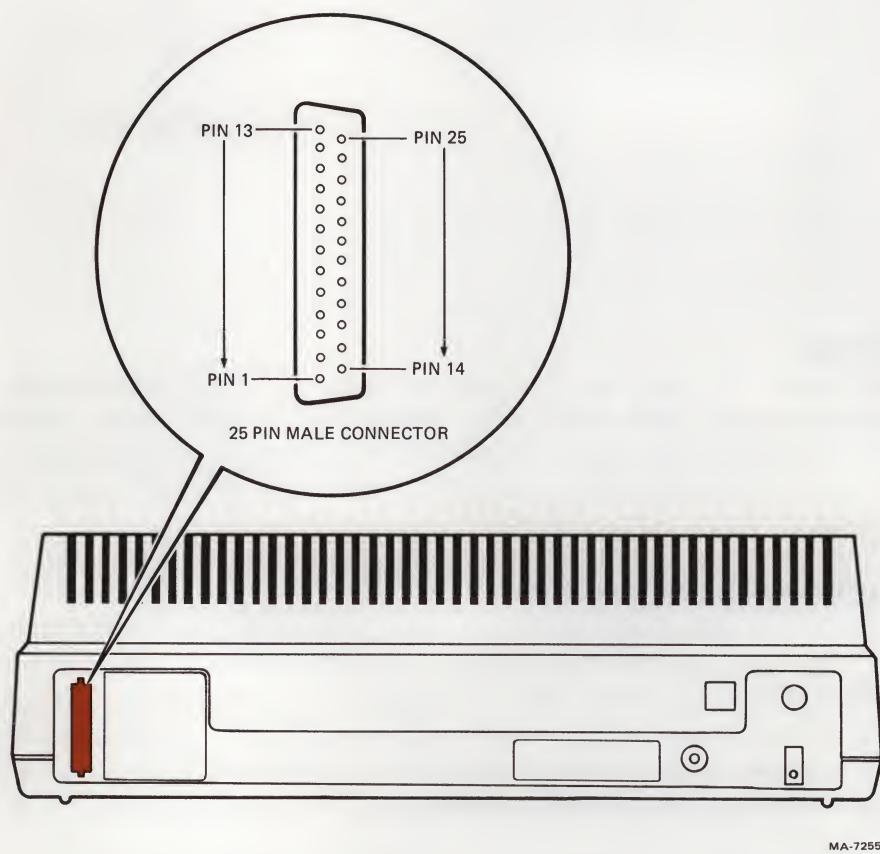
Protective Ground – Pin 1

Protective ground is connected to the chassis of the DECwriter IV Graphic Printer. It is also connected to external grounds through the third wire of the power cord.

Transmitted Data (TXD) – Pin 2

Direction: From graphic printer

Signals on this circuit represent serially encoded characters that are generated by the graphic printer.



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Figure 5-1 EIA Connector

Received Data (RXD) - Pin 3

Direction: To graphic printer

The graphic printer receives serially encoded characters generated by the computer on this circuit.

Request to Send (RTS) - Pin 4

Direction: From graphic printer

When the RTS signal is on, the graphic printer intends to receive data.

Clear to Send (CTS) - Pin 5

Direction: To graphic printer

This circuit monitors the CTS signal generated by the modem in response to RTS.

Data Set Ready (DSR) - Pin 6

Direction: To graphic printer

The DSR signal is on when the data set is ready. The graphic printer will not receive data until this signal is on.

Table 5-1 EIA Interface Signals

Pin Number	Name	Description	Circuit CCITT/EIA
1		protective ground	101/AA
2	TXD	transmitted data	103/BA
3	RXD	received data	104/BB
4	RTS	request to send	105/CA
5	CTS	clear to send	106/CB
6	DSR	data set ready	107/CC
7		signal ground	102/AB
8	RLSD	receive line signal detect	109/CF
9		no connection	
10		no connection	
11		no connection	
12		no connection	
13		no connection	
14		no connection	
15		no connection	
16		no connection	
17		no connection	
18		no connection	
19		no connection	
20	DTR	data terminal ready	108.2/CD
21		no connection	
22		no connection	
23		no connection	
24		no connection	
25		no connection	

Signal Ground - Pin 7

This circuit establishes a common ground reference potential for all interface circuits. This circuit is permanently connected to the protective ground circuit.

Receive Line Signal Detect (RLSD) - Pin 8

Direction: To graphic printer

When the RLSD signal is on, it indicates that the modem has received the data carrier signal. The graphic printer will not receive data until this signal is on.

Data Terminal Ready (DTR) - Pin 20

Direction: From graphic printer

When the DTR signal is on, the graphic printer is capable of receiving data.

COMMUNICATION FEATURES

When on-line, the DECwriter IV Graphic Printer is connected to the communication line and is capable of receiving and sending data. The graphic printer communicates with EIA compatible devices on full duplex asynchronous communication lines.

The graphic printer supports two basic types of full-duplex communication; with or without modem control. Both methods allow data to be transmitted and received at the same time. When full-duplex with no modem control is selected, the data transmission and reception is always enabled when not in local. Full-duplex with modem control requires that both the graphic printer and the modem recognize the proper EIA signals before transmitting data. Table 5-2 shows the effect of the modem/no modem feature on the EIA control signals.

Table 5-2 Modem Control Effect on EIA Signals

EIA Signal	No Modem	Modem Control
DTR	active	active
RTS	active	active
TXD	active	active
RXD	active	active
DSR	inactive	active
CTS	inactive	active
RLSD	inactive	active
Key		
Off	Signal off at EIA connector	
Active	Signal turns off or on depending on state of printer	
On	Signal on at EIA connector	
Inactive	Signal ignored at EIA connector but the DECwriter IV Graphic Printer internally forces signal on	

No modem control allows the graphic printer to communicate directly with a computer (null modem configurations) or with full-duplex modems that do not support DSR (data set ready) or RLSD (receive line signal indicator).

Modem control allows the graphic printer to communicate through modems such as Bell 103, 212, Vadic 3400, or equivalent.

NOTE: The DECwriter IV Graphic Printer does not provide automatic speed control.

The modem/no modem feature is selected or changed using an internal jumper. With the jumper installed, the no modem control feature is selected. With the jumper removed, the modem control feature is selected. The jumper location is shown in the Installation chapter. The graphic printer is initially set to no modem control (jumper installed).

FULL-DUPLEX DISCONNECT

A full-duplex disconnect is accomplished by turning DTR (data terminal ready) off for at least two seconds plus the DSR (data set ready) delay time, but no greater than 3.8 seconds. The following conditions cause a full-duplex disconnect.

- DSR turns off after DTR is on
- RLSD turns off for more than two seconds
- Wrong number time out (DSR is on, then RLSD does not turn on within 20 seconds)
- If the paper fault switch is set to disconnect and a paper out condition occurs
- If the printer is switched to local (by entering self test)

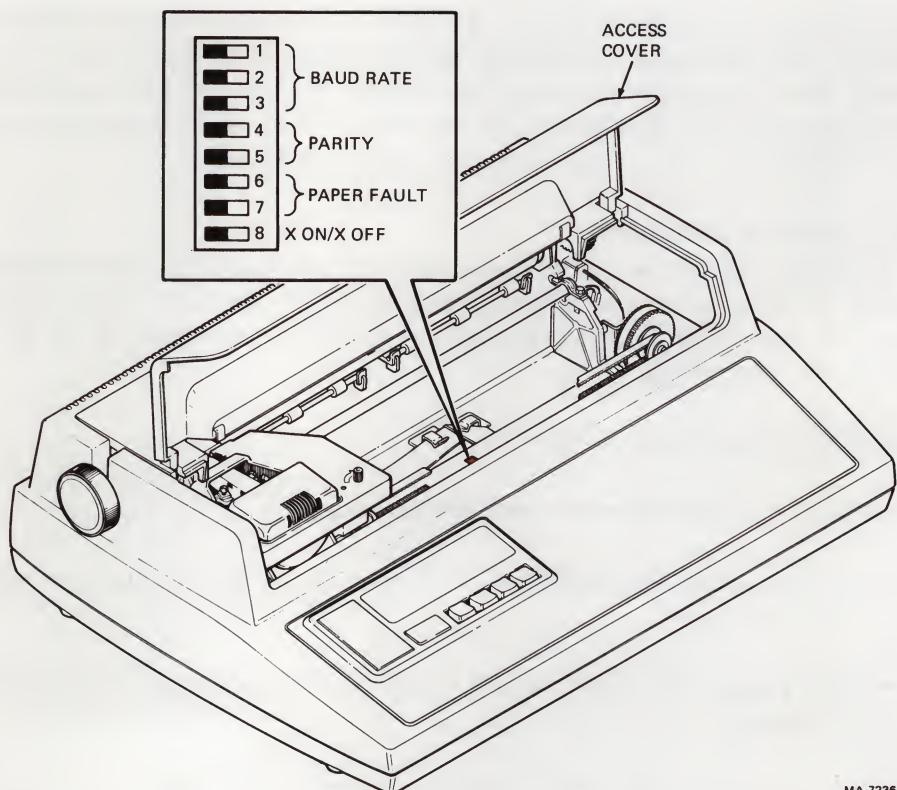
Refer to the Data Communication Switch section for related information.

DATA COMMUNICATION SWITCHES

The DECwriter IV Graphic Printer must be compatible with the computer hardware and software to receive data. The data communication switches allow users to tailor the graphic printer to operate with a specific computer. These switches are usually preset and should not be changed unless compatibility with the computer is verified. After changing a feature, print the status message to verify that the desired feature is selected.

To locate the data communication switches, open the access cover and move the printhead to the left side plate. Figure 5-2 shows the location of the data communication switches and the labeled function of each switch. There are three different switches used in the DECwriter IV Graphic Printers; two types of rocker switches and one slide switch (Figure 5-3). It is important to identify which type switch the printer contains before trying to change any of the communication features. To select a feature using a rocker switch, press the side of the switch that corresponds to the desired selection. To select a feature using a slide switch, push the switch tab to the side that corresponds to the desired selection.

CAUTION: Always use a small blade screwdriver, ball point pen, or equivalent to change a communication feature. Never use a lead pencil.



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Figure 5-2 Data Communication Switch Location

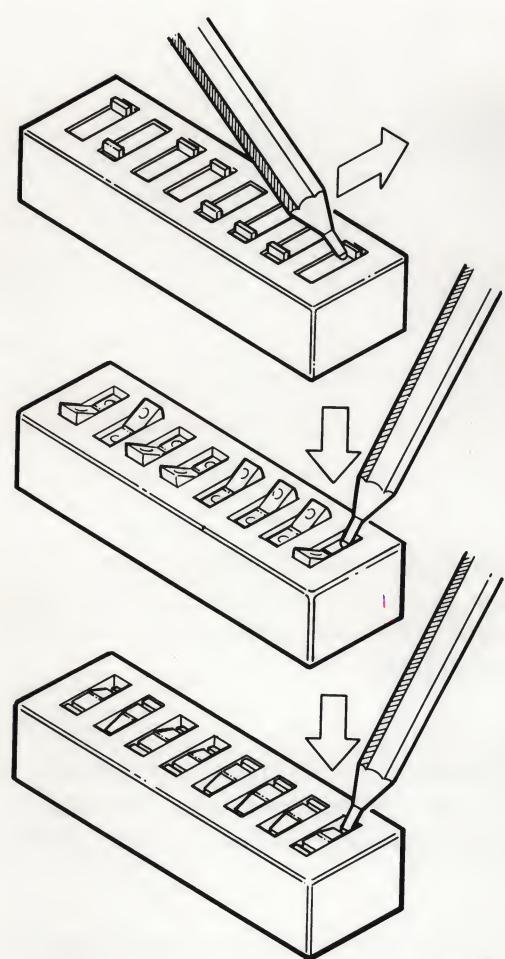
After you select the communication feature, close the access cover, press the CLEAR FAULT key, place the ON LINE/OFF key in the off (down) position, and then press the SELF TEST key to print the status message. Verify that the desired features are selected. To return on-line after the status message is printed, press the SELF TEST key again to exit self test, press the ON LINE/OFF key again to place the switch in the on-line (up) position. The following paragraphs describe each communication feature in detail.

Baud Rate (Switches 1, 2 and 3)

The baud rate feature determines the graphic printer's transmit and receive speed (bits per second). Split baud rates are not allowed. Table 5-3 lists the speeds at which the graphic printer is capable of transmitting and receiving data, and the switch settings (right or left) for each selection.

Parity (Switches 4 and 5)

The parity feature is used to check the accuracy of data transmitted between the graphic printer and the host computer. The graphic printer indicates parity errors by printing the SUB (⌘) character in place of the character received in error. The parity feature must be compatible with the computer. Parity is only checked when even or odd parity is selected. Table 5-4 shows the parity selections and the switch settings (right or left) for each selection.



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Figure 5-3 Data Communication Switch Types

Table 5-3 Baud Rate Selections

Baud Rate	Switch Settings
	1 2 3
110	R R R
300	L R R
600	R L R
1200	L L R
1800	R R L
2400	L R L
4800	R L L
9600	L L L

R = Right

L = Left

Table 5-4 Parity Selections

Parity	Switch Settings	
	4	5
Space	R	R
Mark	L	R
Even	R	L
Odd	L	L

R = Right
L = Left

Paper Fault (Switches 6 and 7)

This feature functions when the paper low option (LAX34-LL) is installed to detect a roll paper fault, or when the paper out option (LAX34-PL) is installed to detect a fanfold paper fault. The option must not be overridden in order for paper fault detection to operate.

No Action (Switches 6 Right and 7 Right)

The no action feature is usually selected for hardwire installations, or when no disconnect is desired. When no action is selected and the XON/XOFF feature is off, the graphic printer continues to print and ignores the paper fault.

When no action is selected and the XON/XOFF feature is on, the graphic printer responds to the paper fault by sending an XOFF to the computer.

Paper Low (Switches 6 Left and 7 Right)

When paper low is selected the graphic printer finishes the current printing activity. After disconnect occurs, the printer does not answer any incoming calls. After (DTR) is turned off, the POWER/FAULT light flashes. This feature has no effect when the modem/no modem feature is set to no modem.

Paper Out A (Switches 6 Right and 7 Left)

When paper out A is selected the POWER/FAULT indicator flashes and the printer immediately turns DTR off.

Paper Out B (Switches 6 Left and 7 Left)

When paper out B is selected the POWER/FAULT indicator flashes and the printer immediately transmits a 275 ms 25 ms break signal.

Table 5-5 lists each signal response and the switch settings (right or left) for each response.

Table 5-5 Paper Fault Response Selections

Feature	Response	Switch Settings	
		6	7
No action	none	R	R
Paper low	do not turn DTR on (after disconnect)	L	R
Paper out A	drop DTR	R	L
Paper out B	send 275 ms (break signal)	L	L

XON/XOFF (Switch 8)

The XON/XOFF feature is used to prevent input buffer overflows. When XON/XOFF is selected, the graphic printer constantly monitors the number of characters stored in the input buffer. The graphic printer signals (XOFF) the computer to stop sending data during the following conditions.

- Number of characters in the input buffer exceeds 112 characters
- Access cover is opened
- Paper out or paper low is detected (if the paper out or paper low detection option is installed and not overridden)
- Printhead jam
- Printer is switched off-line
- Graphic printer transmits XOFF and then receives 60 characters
- Power to the terminal is turned on while off line and the computer attempts to send data

The graphic printer signals (XON) the computer to resume data transmission during the following conditions.

- When the number of characters in the input buffer is less than 30 characters
- When the fault condition (paper out, paper low, printhead jam, open cover) is corrected and the CLEAR FAULT key is pressed

- Printer is switched on-line
- Power to the terminal is turned on while on-line

XON/XOFF may be used for either local or remote operation. To select XON/XOFF set switch 8 to the left. To turn the XON/XOFF feature off, set switch 8 to the right.

INPUT BUFFER OVERFLOW PREVENTION

When the DECwriter IV Graphic Printer receives a character (other than the NUL and DEL characters), the printer stores the character in its 250 character input buffer. When the printer is ready, characters are removed from the input buffer and printed. If the printer falls behind by more than 250 characters, the input buffer overflows and data is lost. There are three ways to avoid input buffer overflows.

1. Send data only as fast as it can be printed. When receiving data at 300 baud or less the graphic printer can keep up with character reception. However, very short lines and multiple form feeds are not processed this fast. Also, characters received faster than 300 baud cannot be processed that quickly. In these cases, fill characters are used to slow down the effective data transmission speed. Fill time formulas are given in the following Fill Time Formulas section.
2. Limit the number of characters in the message to the graphic printer's input buffer size. If the buffer is empty at the beginning of the transmission, the graphic printer can receive a message of about 250 characters without a buffer overflow.
3. Use the XON/XOFF feature to signal the data source when to temporarily stop or resume sending data. Using the XON/XOFF feature allows maximum throughput and eliminates the need for fill character calculations and message size limits. This feature is explained in detail in this chapter's Data Communication Switch section.

Fill Time Formulas

When receiving data at 300 baud or less, the graphic printer can keep up with normal character reception. Very short lines and multiple form feeds cannot be printed this fast. Fill characters may be used to slow down the effective data transmission speed in these cases. Fill characters do not enter the input buffer they are stripped out of the data stream upon reception.

The graphic printer's printhead and form movements (horizontal and vertical) graphic printer are directly related to the fill time required to slow down the effective data transmission speed. The fill time required to compensate for these movements can be converted to the number of fill characters needed using the following formula.

$$\text{Number of Fill Characters} = \frac{\text{Fill Time Required}}{\text{Character Execution Time}}$$

NOTE: NUL is the only recommended fill character even though some other characters seem to achieve the same result in special cases.

Determining Fill Time Required

Required fill time for horizontal Movement (including tabs and positoning sequences) is determined in the following way.

First figure the actual number of columns moved. Then, allow 15 ms for each of the first 10 columns (30 ms in double-width pitches: 5, 6, 6.6, 8.25) and 5.5 ms for each additional column (11 ms in double-width pitch-es).

Required fill time for vertical movement (includes linefeeds, vertical tabs, form feeds, and vertical positioning sequences) is determined in the fol-lowing way.

First convert the number of lines moved to actual distance moved using the following formula.

$$\text{Inches Moved} = \frac{\text{Number of Lines Moved}}{\text{Vertical Pitch}}$$

Then allow 38 ms for the first line moved up to 1/6 inch, and 200 ms for each additional inch.

Character Execution Time

The character execution time is given in milliseconds and is based on a given baud rate. It is the time the computer takes to slow down the effec-tive data transmission speed to the printer. Character execution times at the applicable baud rates are shown in Table 5-6.

Table 5-6 Character Execution Times

Baud Rate	Execution Times (ms)
110	90.0
300	33.3
600	16.6
1200	8.3
1800	5.5
2400	4.1
4800	2.0
9600	1.0

NOTE: Character execution times are provided for calculation of fill times only.

Fill Time Formula Examples

1. Horizontal Movement

Assumed values: Baud Rate = 1200, Horizontal Pitch = any single width pitch (10, 12, 13.2, 16.5). Also assume that horizontal tab stops are set at columns 9, 17, and 25 and printing begins at column 9. If the next two characters received are TAB TAB, calculate the number of fill characters required in the following way.

First, calculate the number of columns moved using the following formula.

$$\text{Final Column} - \text{Current Column} = \text{Number Columns Moved}$$

$$25 - 9 = 16$$

Then allow 15 ms per column for the first 10 columns and 5.5 ms per column for the remaining columns.

$$15 \text{ ms} \times 10 = 150 \text{ ms}$$

$$5.5 \text{ ms} \times 6 = 33 \text{ ms}$$

$$150 + 33 \text{ ms} = 183 \text{ ms}$$

The fill time required is 183 ms.

Next, divide the fill time required by the character execution time found in Table 5-6.

$$\text{Number Fill Characters Required} = \frac{183 \text{ ms}}{8.3 \text{ ms}}$$

The number of fill characters required is 22.04. Round this number off to the next whole number, which is 23. Twenty three (23) fill characters (NUL) should follow the two tabs.

2. Vertical Movement

Assumed values: Baud Rate = 1200 baud, Vertical Pitch = 6 lines per inch and paper is set to line 10. Also assume the next characters received are nine line feeds.

First, calculate the actual distance moved using the following formula.

$$\text{Number Inches Moved} = \frac{\text{Lines Moved}}{\text{Vertical Pitch}}$$

$$1\frac{1}{2} \text{ inches} = \frac{9}{6}$$

Then allow 38 ms for the first 1/6 inch moved and 200 ms for the remaining number of inches moved.

$$200 \text{ ms} \times 1 \frac{2}{6} \text{ inches} = 266 \text{ ms}$$

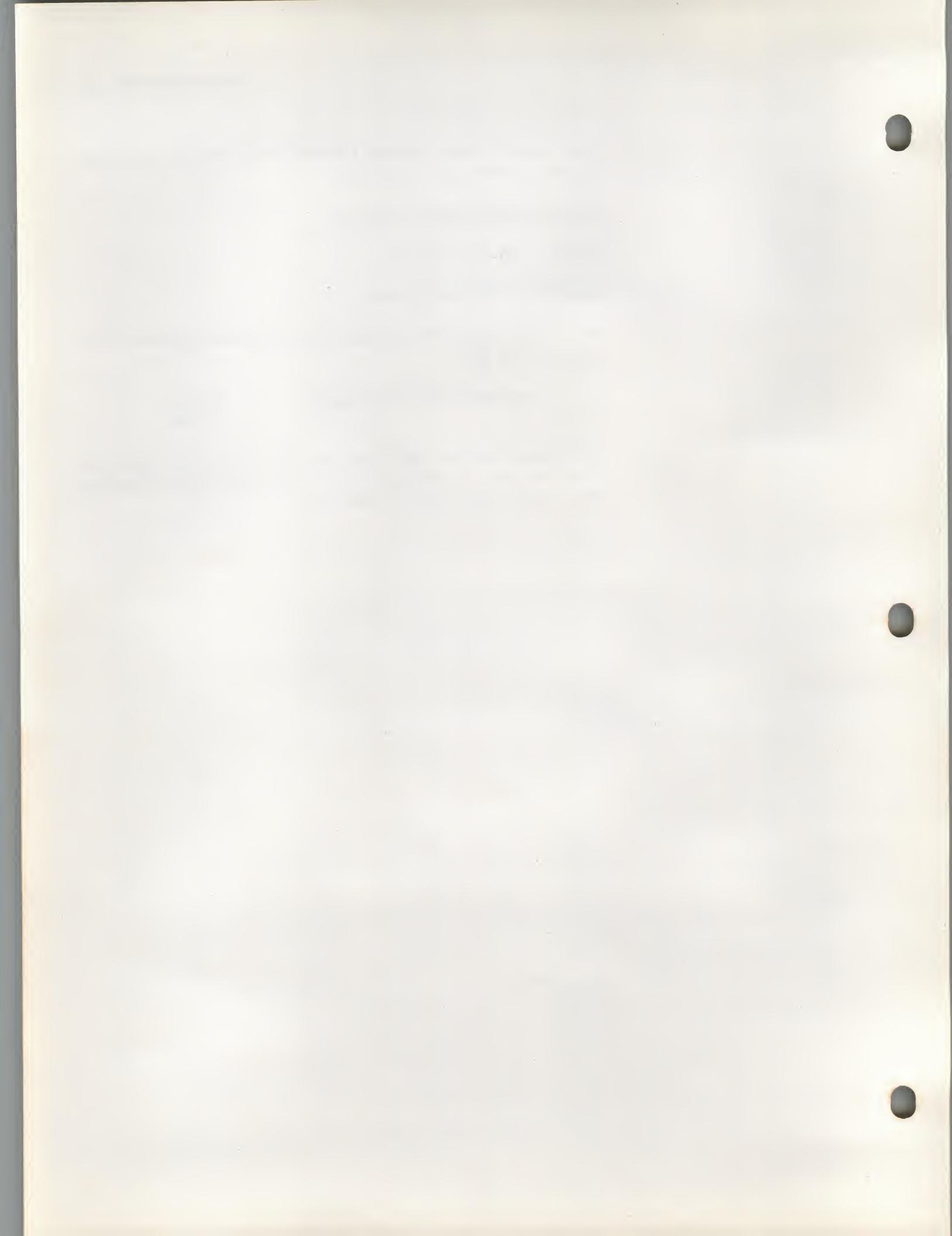
$$266 \text{ ms} + 38 \text{ ms} = 304 \text{ ms}$$

The fill time required is 304 ms.

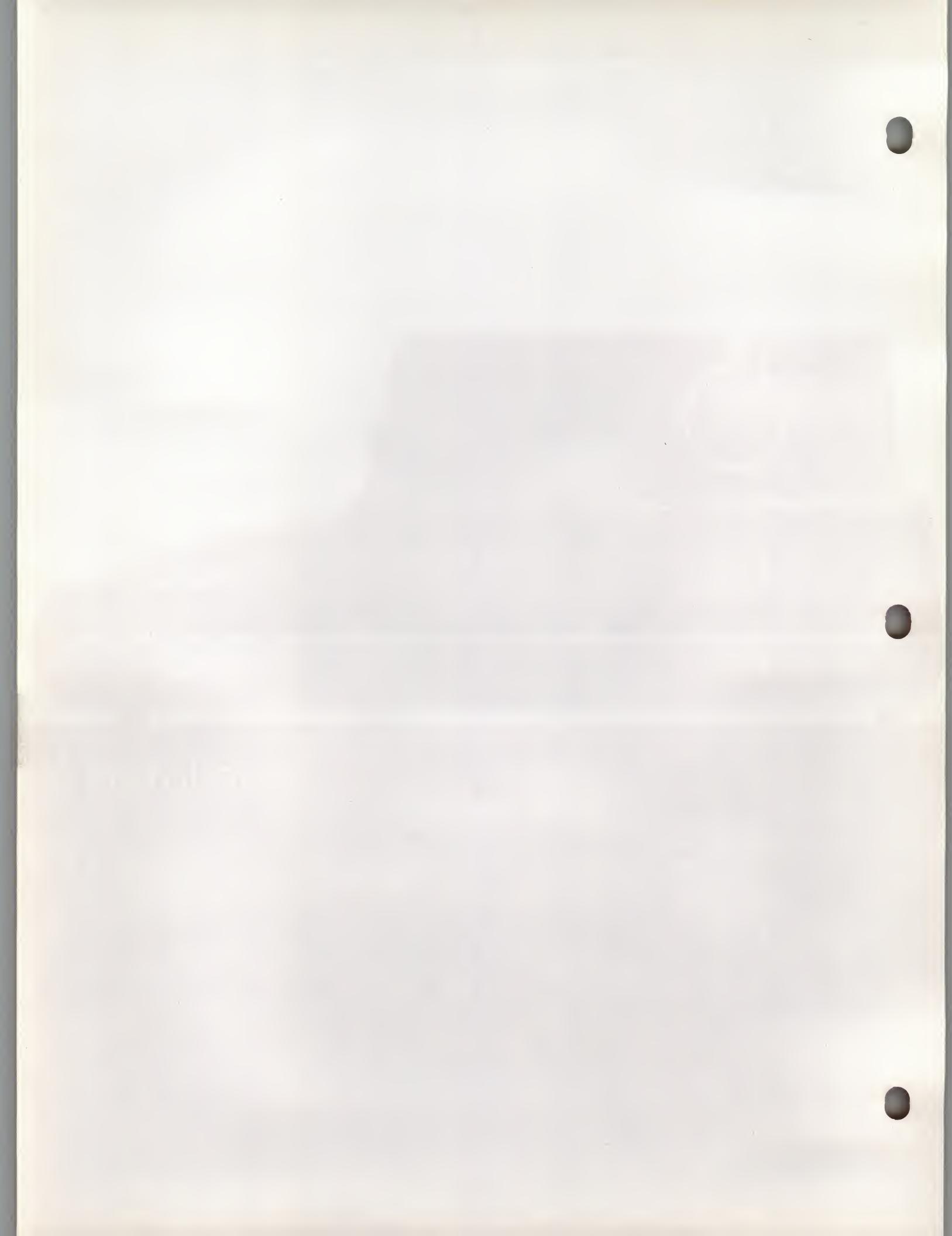
Next, divide the fill time required by the character execution time found in Table 5-6.

$$\text{Number fill characters required} = \frac{266 \text{ ms}}{8.3 \text{ ms}}$$

The number of fill characters required is 32.04. Round this number off to the next whole number, which is 33. Thirty three (33) fill characters (NUL) should follow the nine line feeds.



Installation



INSTALLATION INFORMATION

GENERAL

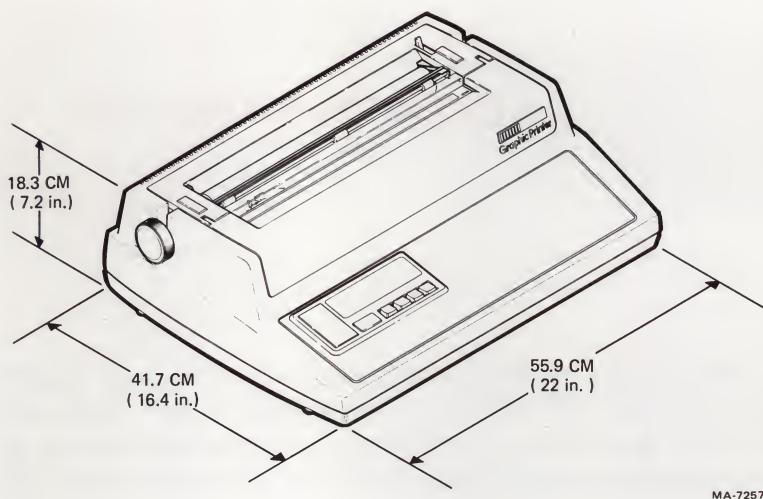
This chapter contains step by step procedures used to unpack, inspect, power up, and check out the DECwriter IV Graphic Printer. These procedures allow you to verify that the equipment is not damaged and is operating properly before connecting the printer to the communication system.

SITE CONSIDERATIONS

Install the printer in an area that is free from excessive dust, dirt, corrosive fumes, and vapors. To prevent over heating, do not block the ventilation openings on the bottom of the graphic printer. Table 6-1 lists DECwriter IV Graphic Printer environmental and power requirements. Figure 6-1 shows printer dimensions. Complete specifications are contained in Appendix A.

Table 6-1 Site Considerations

Site Consideration	Specification
Temperature	10° to 40° C (50° to 104° F)
Relative humidity	10 to 90 percent with maximum wet bulb temperature of 28° C (82° F) and minimum dew point of 2° C (36° F) noncondensing
Input voltage	90 to 128 Vac 180 to 256 Vac (switch selectable)
Power consumption	Printing 45 watts maximum Nonprinting 25 watts maximum
Power receptacle	Nonswitched, three prong, grounded receptacle



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Figure 6-1 DECwriter IV Graphic Printer Dimensions

UNPACKING AND INSPECTION

Perform the following procedure to unpack and inspect the DECwriter IV Graphic Printer. A pair of diagonal cutters is required.

1. Open the top of the shipping carton (Figure 6-2).
2. Lift the printer up and out of the carton and place it on a flat, clean work surface (Figure 6-2).
3. Remove the shock absorbing material and packing from around the printer (Figure 6-2).
4. Remove the documentation package, power cord and any other cables (Figure 6-2).
5. Carefully inspect the housing and carriage assembly for obvious shipping damage. Check the enclosed packing list for lost or missing items. Report any damaged or missing items to the local carrier and your DIGITAL branch office.
6. Open the access cover. Clip and remove the nylon cable tie securing the printhead assembly (Figure 6-3). Close the access cover.
7. If necessary, wipe the outer surfaces with a clean, soft, lint-free cloth.

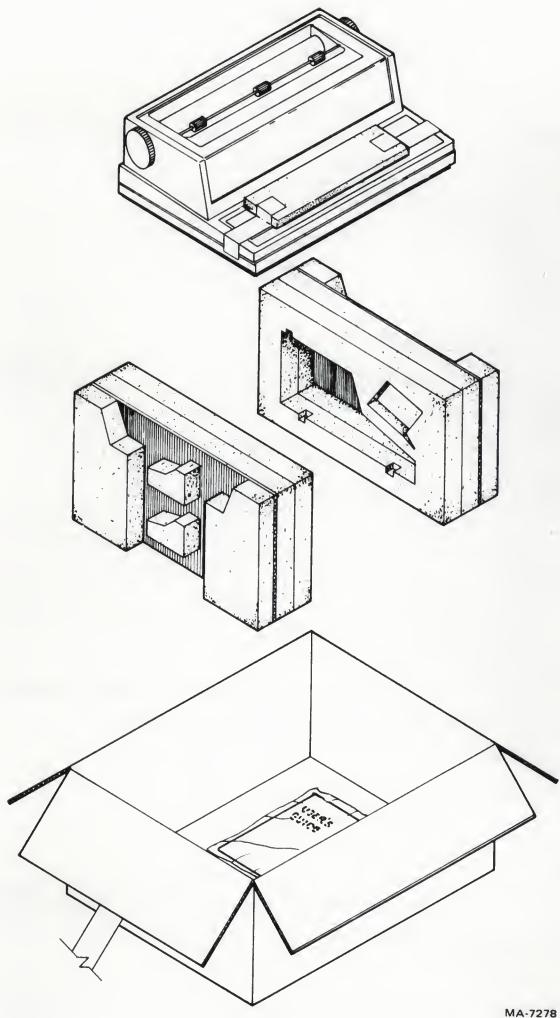
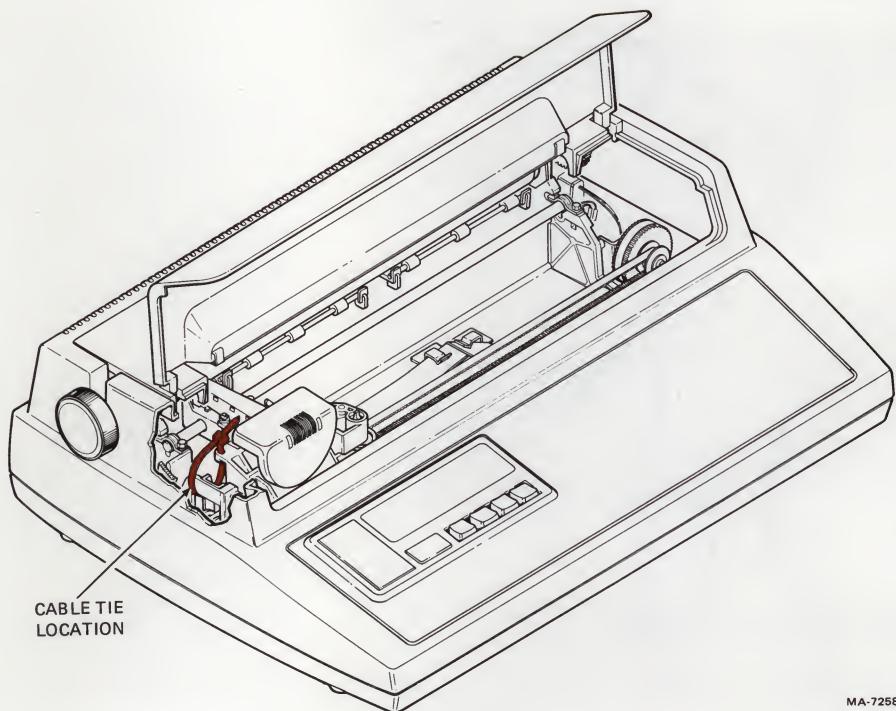


Figure 6-2 Unpacking / Repacking

REPACKING PROCEDURES

Perform the following procedure to repack the DECwriter IV Graphic Printer.

1. Remove the ribbon cartridge and paper.
2. Secure the printhead assembly to the left side plate with a nylon cable tie to prevent movement while in transit (Figure 6-3).
3. Repack the printer as shown in Figure 6-2.



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Figure 6-3 Cable Tie Location

INSTALLING THE PRINTER

Perform the following procedure to install the DECwriter IV Graphic Printer. A small blade screwdriver or ball point pen is required.

1. Select the modem control communication feature if desired (refer to the Jumper section in this chapter).

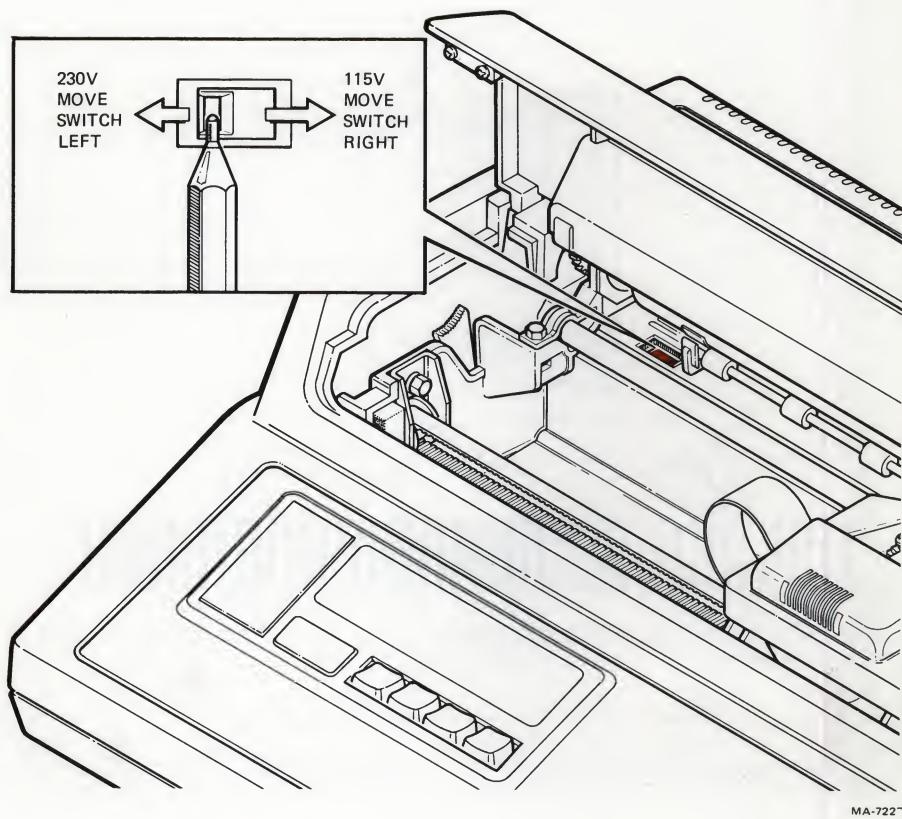
NOTE: See the Communication Chapter for more detail on the modem communication feature.

2. Lift the access cover. Then, using a small blade screwdriver or ball point pen select the desired ac input voltage range (Figure 6-4).

CAUTION: Always use a small blade screwdriver, ball point pen, or equivalent to change the voltage range. Never use a pencil.

3. Install any options if required. (See the Options chapter for more detail).
4. Connect the interface cable to the interface connector on back of the printer (Figure 6-5). Refer to the cable summary in this chapter for more detail on interface cables.

NOTE: Site plans are not supplied by Digital Equipment Corporation. Interface logic connections must be specified and provided by



MA-722™

Figure 6-4 Voltage Selector Switch

the system supplier or the customer because each installation may be different.

5. Install a ribbon cartridge according to the ribbon cartridge installation procedure (refer to the Printer Preparation chapter).
6. Install paper according to the paper/forms loading procedure (refer to the Printer Preparation chapter).
7. Connect the line cord to a nonswitched, three prong, grounded wall receptacle.

Modem/No Modem Jumper

When the modem/no modem jumper is installed, no modem operation is selected. When the modem/no modem jumper is removed the modem feature is selected. To select the modem feature perform the following procedure. A small blade screwdriver and a pair of diagonal cutters are required.

1. Verify that the ac power cord is not plugged into a power source. Remove the other end of the power cord from the back of the printer.

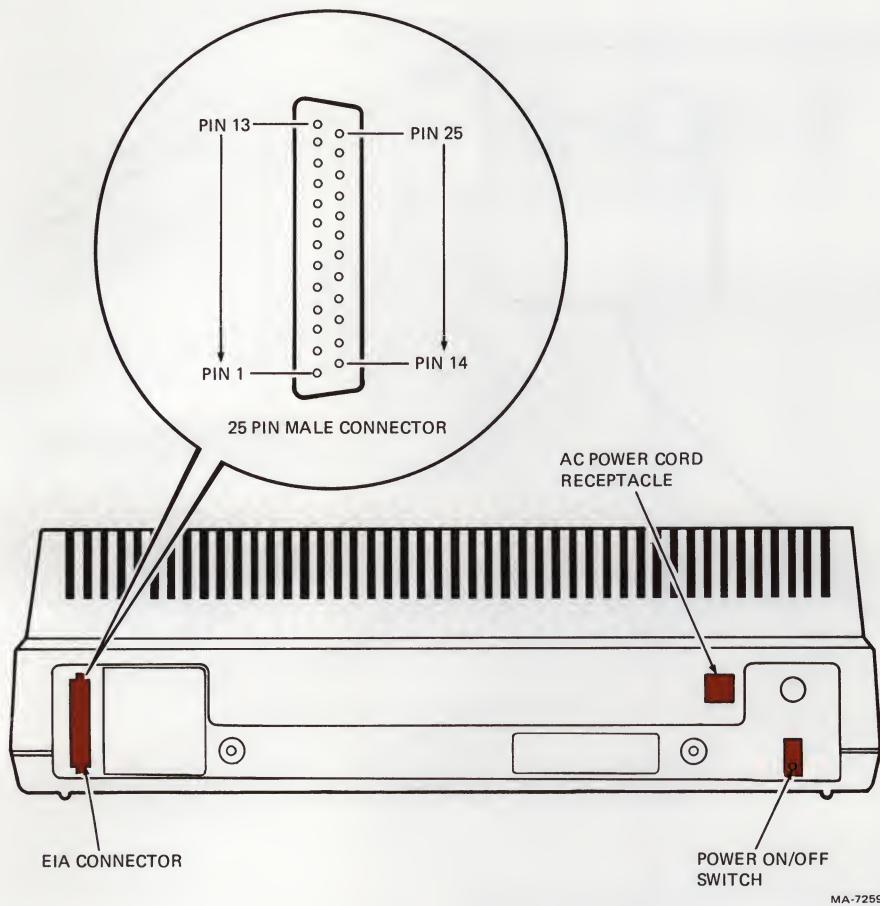
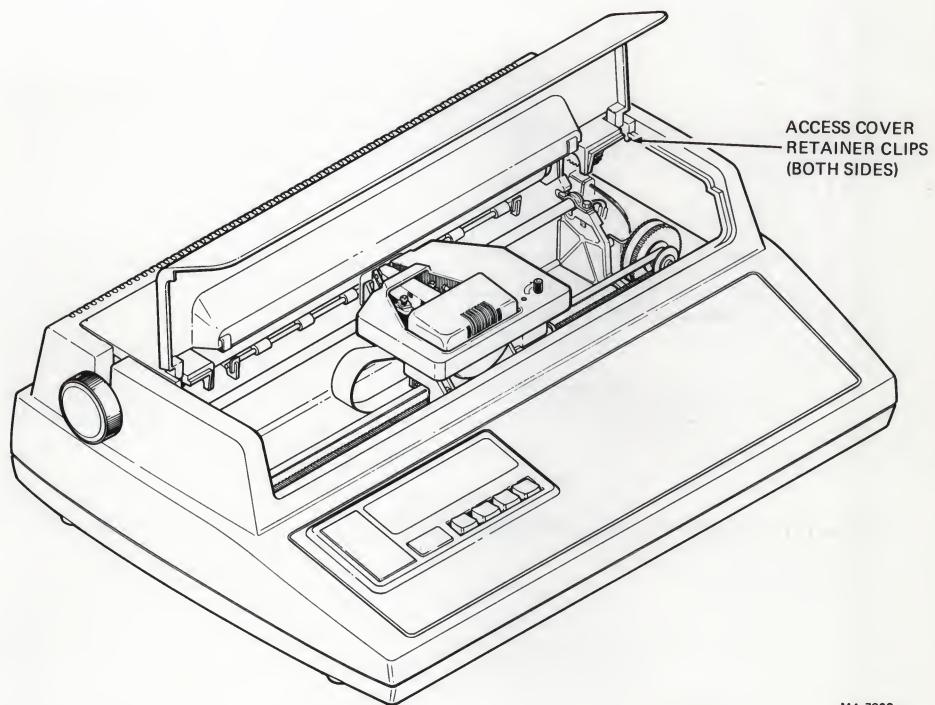


Figure 6-5 DECwriter IV Graphic Printer (Rear View)

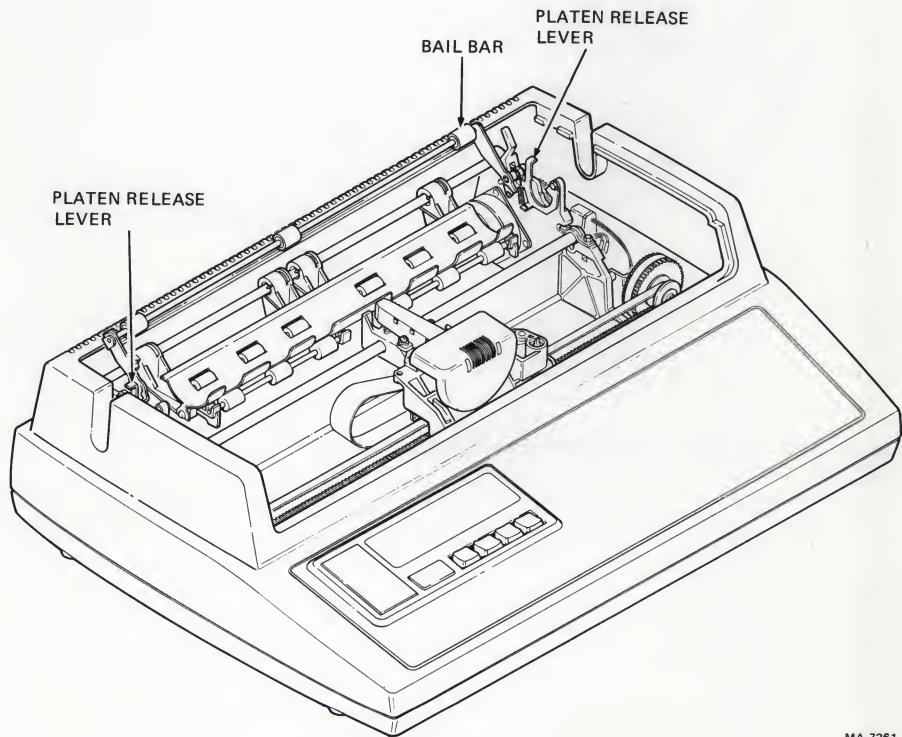
2. To remove the access cover lift the access cover and press the two retainer clips (Figure 6-6). Lift the access cover away from the printer housing.
3. Lift the bail bar to gain access to the platen (Figure 6-7). Press the two platen release levers and lift the platen straight up. Lower the bail bar to its original position.
4. With a small blade screwdriver, release the four snap fasteners that secure the printer housing to the base assembly (Figure 6-8). Lift the printer housing away from the base assembly.
5. Press the bezel retainer clips and rotate the operator control panel bezel toward the front of the printer (Figure 6-9).
6. The modem/no modem jumper can now be seen (Figure 6-10). Cut the jumper to select the modem feature.

CAUTION: Make sure to remove the entire jumper. Any metal piece remaining may disturb the electronic operation of the printer.



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Figure 6-6 Access Cover Removal



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Figure 6-7 Platen Removal

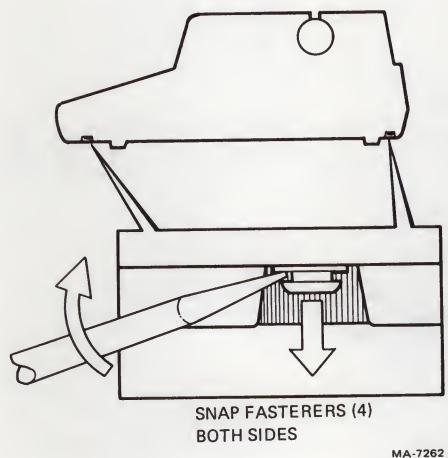


Figure 6-8 Printer Housing Removal

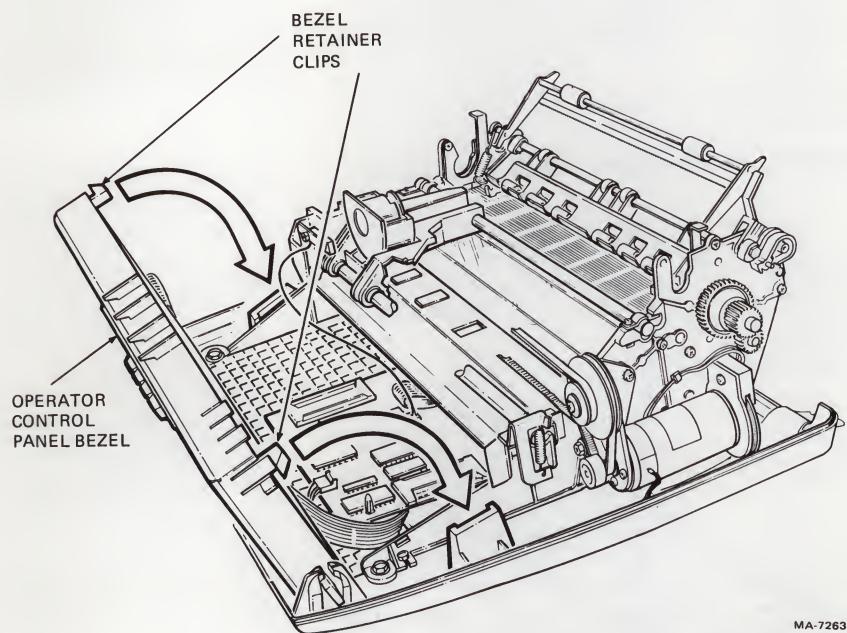
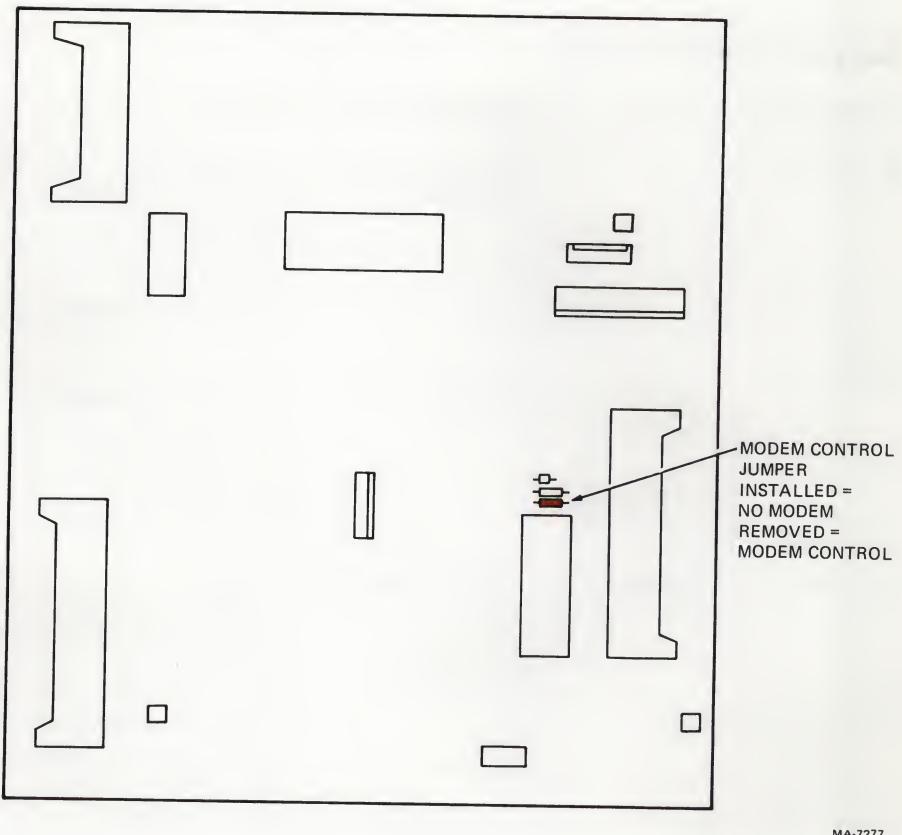


Figure 6-9 Operator Control Panel Bezel



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Figure 6-10 Modem/No Modem Jumper Location

7. Make sure the bezel is properly seated, then rotate the bezel to its original position.
8. Place the printer housing onto the base assembly. Press the snap fasteners to secure the housing to the base assembly.
9. Lift the bail bar and press the platen into its original position. The platen clicks into place when properly seated. Lower the bail bar to its original position.
10. Slide the back edge of the access cover under the lip in the printer housing, and press the access cover into its original position.
11. Plug the ac power cord into the ac power cord receptacle on the back of the printer (Figure 6-5). Then plug the power cord into a non-switched, three prong, grounded outlet.

Cable Summary

Table 6-2 lists the interface cables that can be used with the DECwriter IV Graphic Printer. To order these cables refer to the Accessories and Supplies chapter. Figure 6-11 shows connection examples of each cable.

Table 6-2 Interface Cables

Part Number	Length	Connector Type	Purpose
BC22A-10	.3 m 10 ft	RS-232-C female to female	Null modem, six conductor, shielded cable, used for a direct connection between graphic printer and computer
BC22A-25	7.6 m 25 ft	RS-232-C female to female	Null modem, six conductor, shielded cable, used for a direct connection between graphic printer and computer
BC03M-xx	variable	RS-232-C female to female	Null modem, six conductor, shielded cable, used for a direct connection between graphic printer and computer instead of BC22A when cable length required exceeds 25 feet
BC22B-10	3 m 10 ft	RS-232-C female to male	Extension, 14 conductor, shielded cable used to connect the graphic printer to a data set (modem) or acoustic coupler
BC22B-10	7.6 m 25 ft	RS-232-C female to male	Extension, 14 conductor, shielded cable, used to connect the graphic printer to a data set (modem) or acoustic coupler
*BC05X-xx	variable	Mate-N-Lok	20 mA extension cable, used for a direct connection between graphic printer with a 20 mA option installed and the computer
30-10958-02	EIA: 8 ft 20 mA: 45 cm 18 in	2.4 m RS-232-C male to female 45 cm male 18 in	DF01-A interface cable, used to connect the graphic printer to a DF01-A Acoustic Telephone Coupler

*A BC05X-15 cable is shipped with the 20 mA current loop option.

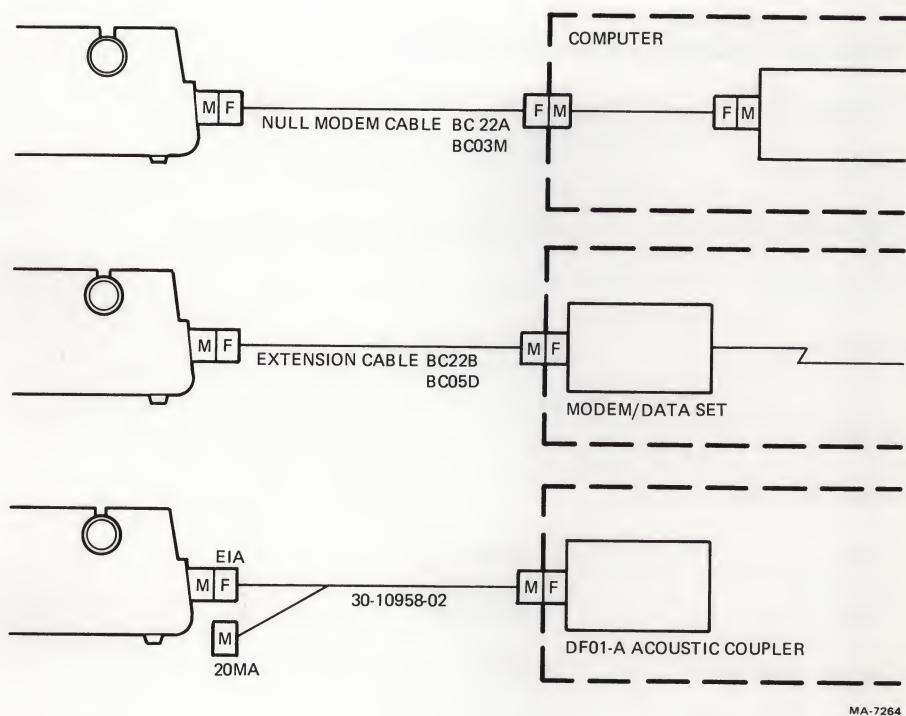


Figure 6-11 Cable Connection Examples

POWER UP AND CHECKOUT PROCEDURES

Perform the following procedure to power up the DECwriter IV Graphic Printer and verify proper operation.

1. Set the POWER ON/OFF switch to on (Figure 6-5). Make sure the POWER/FAULT indicator lights, and the printhead automatically positions itself to the left margin. The graphic printer features are set to the values listed in Table 6-3.

NOTE: When power to the graphic printer is turned on it automatically runs a power up self test. The indicators on the operator control panel are used to display any power up self test failures. If the graphic printer does not power up correctly, refer to the Troubleshooting section in the Testing and Troubleshooting chapter.

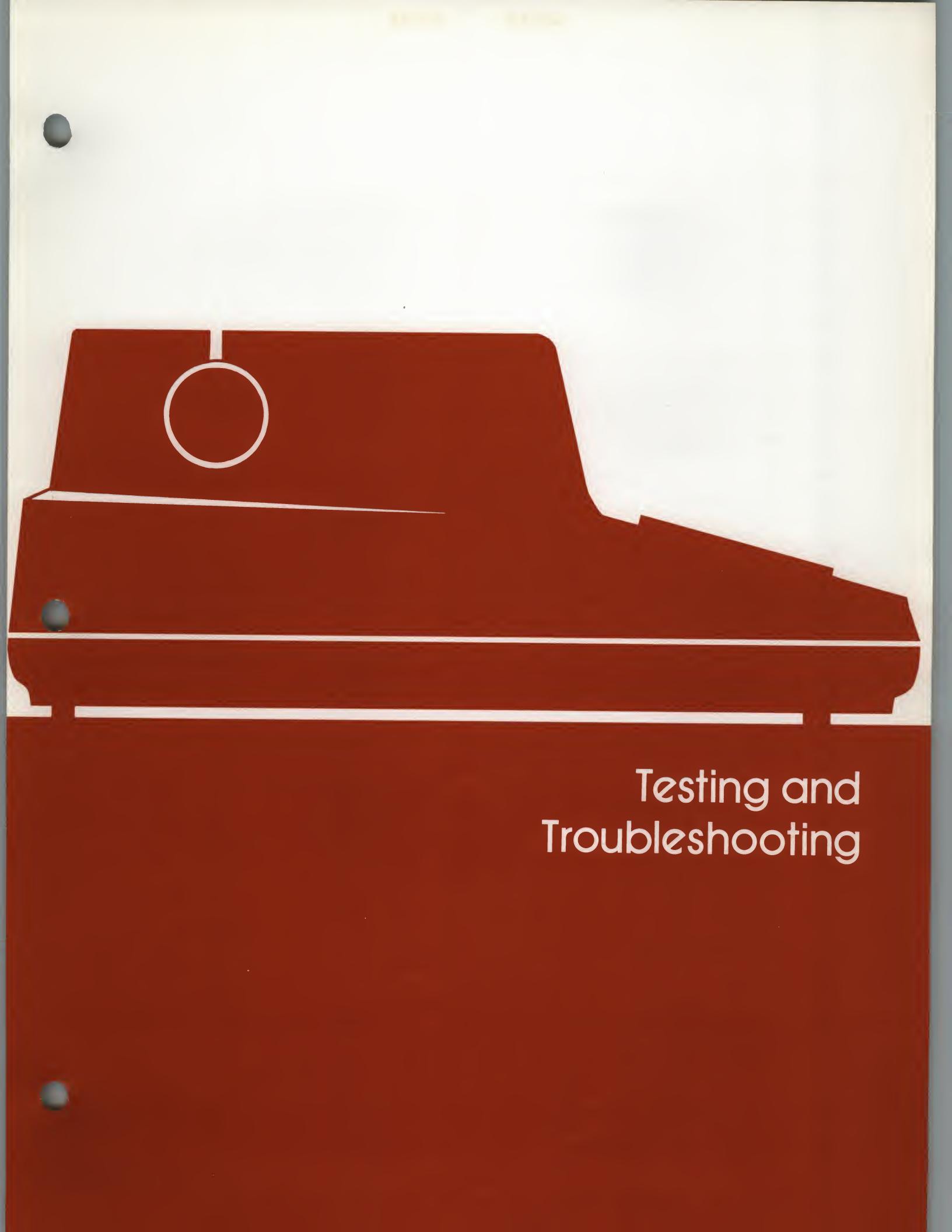
Table 6-3 Feature Default Values

Feature	Setting
Character set	USASCII character set
Horizontal pitch	10 characters per inch (char/in)
Left margin	Column 1
Right margin	Column 132
Horizontal tab stops	Columns 1, 9, 17, 25, 33, 41, 49, 57, 65, 73, 81, 89, 97, 105, 113, 121, 129
Vertical pitch	6 lines per inch (lines/in)
Form length	66 lines
Top margin	Line 1
Bottom margin	Line 66
Vertical tab stops	Every line
Data communication features	Set according to switches

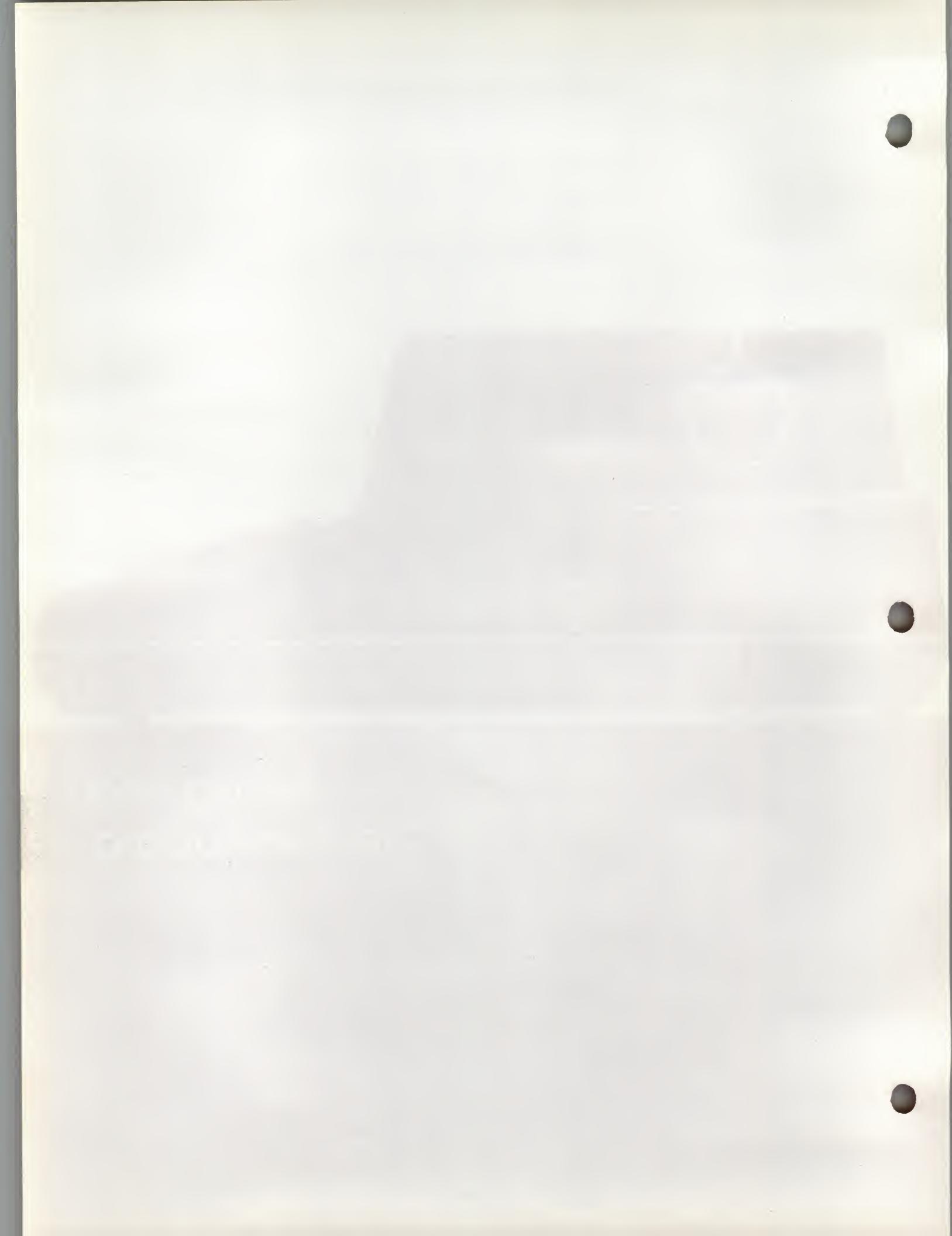
2. Print the status message to verify proper printer operation. To print the status message, press and lock the SELF TEST key in the down position.

NOTE: When the SELF TEST key is pressed, the graphic printer enters a local condition and immediately disconnects from the communication line. Any data sent to the printer after the SELF TEST key is pressed is lost. If a modem is being used, communication with the computer must be restored.

3. After you have verified that the printer is operating correctly, select the desired data communication features (refer to the Communication chapter for more detail on the data communication switches).



Testing and Troubleshooting



7

TESTING AND TROUBLESHOOTING

GENERAL

This chapter describes the DECwriter IV Graphic Printer self tests, a troubleshooting checklist, and all maintenance procedures. The Self Test section describes the power up self test, status message, printer self tests, and data loopback test. The Troubleshooting section lists a series of checks to make before requesting service. The Maintenance section describes procedures to keep the graphic printer in good operating condition.

SELF TESTS AND STATUS MESSAGE

The DECwriter IV Graphic Printer is capable of printing a status message and performing the following self tests.

- Power Up Self Test
- Printer Self Tests
 - Character Pattern
 - Vertical Bar
 - Nonprinting
- Data Loopback Test

The following paragraphs describe the graphic printer self tests and status message.

Power Up Self Test

The graphic printer performs a power up self test whenever power to the printer is turned on. Any errors during self test are displayed by the operator control panel indicators.

Refer to Table 7-1 for the power up self test indications. If the graphic printer fails to pass the power up self test, the operator should request service.

Table 7-1 Power Up Self Test Indications

POWER/FAULT Indicator	DSR Indicator	Probable Cause	Action
Off No carriage motion	Off	Power supply	Refer to Table 7-2
Off Carriage motion	Off	Defective Indicators	Request service
Off	On	Defective logic board	Request service
Off	Flashing	Defective logic board	Request service
Flashing No bell	On or Off	Cover open, or paper fault	Close cover, press CLEAR FAULT key
Flashing Bell tones	On or Off	Head jam	Clear jam, press CLEAR FAULT key
On	On	On line / ready to receive data	
On	Off	SELF TEST key was pressed before power up, or printer is in modem mode with no DSR signal	Release self test key

Status Message and Printer Self Tests

The graphic printer has a status message feature and three printer self test features. The status message includes the following information.

- Current microcode version
- Data communication features selected
- G0 and G1 character set designated
- Horizontal pitch selected
- Vertical pitch selected
- Current state of modem/no modem jumper

NOTE: The character set, horizontal pitch, and vertical pitch features cannot be changed by the operator. These features are selected by the computer.

```

VA1.0

Parity: S
Speed: 2400
GO: US
GI: US
CPI: 10
LPI: 6
Disconnect: No

Xon/Xoff: Y
Modem: N

```

Figure 7-1 Sample Status Message

A sample status message is shown in Figure 7-1.

NOTE: After the communication features are selected, print and store a copy of the status message. The status message is a useful tool for a service technician if your terminal needs repair.

The printer self tests provide a visual indication that the printer is working properly. The operator can perform any of the following three printer self tests to determine if a problem exists.

- Character Pattern
- Vertical Bar
- Nonprinting

Figure 7-2 shows examples of the character pattern and vertical bar self test patterns. During the character pattern self test 94 characters are continuously printed within the selected margins. The vertical pattern self test prints vertical lines within the selected margins. The nonprinting self test causes the carriage to move from the left margin to the right margin, back to the left margin, and then advance one line. This test repeats until the operator stops the test.

```

! "#$%&' ()*+,-./0123456789:@<=>?@ABCDEFGHIJKLMNPQRSTU VWXYZ[\]^_`ab
#$%&' ()*+,-./0123456789:@<=>?@ABCDEFGHIJKLMNPQRSTU VWXYZ[\]^_`abc
#$%&' ()*+,-./0123456789:@<=>?@ABCDEFGHIJKLMNPQRSTU VWXYZ[\]^_`abcd
$%&' ()*+,-./0123456789:@<=>?@ABCDEFGHIJKLMNPQRSTU VWXYZ[\]^_`abcde
%&' ()*+,-./0123456789:@<=>?@ABCDEFGHIJKLMNPQRSTU VWXYZ[\]^_`abcdef

```



Figure 7-2 Character Pattern and Vertical Bar Self Test Examples

Perform the following procedure to obtain the status message or run one of the self tests.

Procedure	Comments/Indications
-----------	----------------------

Press and lock the ON LINE /
OFF • key in the OFF •
(down) position.

NOTE: When the SELF TEST key is pressed, the DECwriter IV Graphic Printer enters a local condition and immediately disconnects from the communication line. Any data sent to the printer after the SELF TEST key is pressed is lost, and communication with the computer must be re-established.

Press and lock the SELF TEST key in the down position.

The status message is printed.

NOTE: If the SELF TEST key is in the down position, release the SELF TEST key and then relock it in the down position.

Press the FORM FEED key to select the character pattern self test.

The character pattern self test is printed.

Press the FORM FEED key again to change the self test selected.

The self tests are performed in the following order:

Character Pattern
Vertical Bar
Nonprinting
Status Message

NOTE: After performing the vertical bar self test, the top of form reference is lost.

Release the SELF TEST key to stop any of the self tests.

Data Loopback Test

In addition to the printer self tests, a data loopback test can be performed. During the data loopback test, the transmit and receive lines are connected to each other. The printer transmits a set of characters on its transmit lines and receives the characters on its receive lines. All control signals are checked, as are the baud rate and parity. The graphic printer

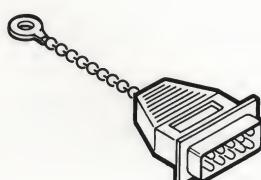
compares the output and input and then prints the status message. The status message includes one of the following messages.

DATA OK - CTRL OK
 DATA ERR - CTRL ERR
 DATA ERR - CTRL OK
 DATA OK - CTRL ERR (20 mA ?)

NOTE: When using the 20 mA interface, the terminal prints the DATA OK - CTRL ERR message when the data loopback test is successfully completed. The 20 mA interface does not use CTRL lines.

During the test the bell is sounded each time 126 characters are successfully transmitted at the correct speed and parity. If the terminal fails the control test (except 20 mA) or the data test, request service.

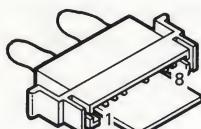
Testing is accomplished with the aid of a loopback connector. EIA and 20 mA connectors are available from the Accessories and Supplies Group, or can be manufactured locally (refer to Figure 7-3). Refer to the Accessories and Supplies chapter for ordering information.



CONNECTORS

FROM PIN	TO PIN	TO PIN
2	3	15
4	5	8
20	6	22
19	12	17

EIA



FROM PIN	TO PIN
2	3
5	7

20 MA

MA-7266

Figure 7-3 EIA and 20 mA Loopback Connectors

Use the following procedure to perform the data loopback test.

Procedure	Comments/Indications
Connect the loopback connector to the graphic printer interface.	
If the 20 mA interface option is used, set the TRANS/REC switches; one to NORMAL and one to ACTIVE (refer to the Options chapter to gain access to the switches).	
Press and lock the ON LINE/OFF • key in the OFF • (down) position.	
Press and lock the SELF TEST key in the down position.	The status message is printed.
Wait four or five seconds after the status message is printed and then press the TOF key to begin the data loopback test.	The data loopback test is started and the graphic printer prints a pass or fail message. The bell tone sounds every time 126 characters are successfully transmitted.
If the 20 mA interface option is used, return the TRANS/REC switches to their original positions (refer to the Options chapter to gain access to the switches).	

NOTE: When the SELF TEST key is pressed, the graphic printer enters a local condition and immediately disconnects from the communication line. Any data sent to the printer after the SELF TEST key is pressed is lost, and communication with the computer must be re-established.

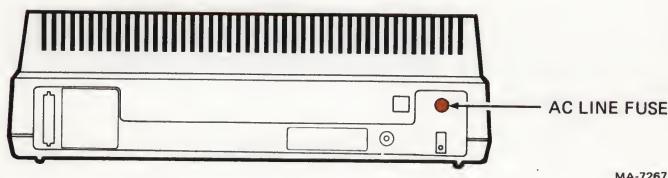
NOTE: If the SELF TEST key is in the down position, release the SELF TEST key and then relock it in the down position.

TROUBLESHOOTING

If you are unable to turn power to the printer on, or if the graphic printer appears to be faulty, refer to Table 7-2. This table describes checks the user should make before requesting service.

Table 7-2 Operator Troubleshooting

Indication	Possible Cause	Action
DECwriter IV Graphic Printer will not turn on when power ON/OFF is set to on	AC power cord is not plugged into the wall receptacle or printer	Plug in cord
	Power is not coming from the wall receptacle	Check the receptacle with a known working device, no power, call your electrician
	AC line fuse blown	Turn printer off and have the fuse replaced, refer to Figure 7-4 for fuse location



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Figure 7-4 AC Line Fuse Location

Characters do not print, POWER/FAULT light flashes	Printer out of paper	Install paper and press the CLEAR FAULT key – refer to Printer Preparation Chapter for paper loading information information
	Access cover open	Close the access cover and press the CLEAR FAULT key
Characters do not print, carriage moves	Printhead too far from paper	Readjust printhead – refer to Printer Preparation chapter for procedure

Table 7-2 Operator Troubleshooting (Cont)

Indication	Possible Cause	Action
Characters do not print or are garbled	Data set (modem) unplugged	Plug in data set
	Incorrect communication set up	Verify that data communication switches are set to match the computer - refer to Communication chapter
Light print	Printhead too far from paper	Readjust printhead - refer to Printer Preparation chapter for procedure
	Ribbon out of ink	Replace ribbon cartridge - refer to Printer Preparation chapter
Ink smudges during print operation	Paper not firmly wrapped around platen	Lift bail bar and smooth the paper over the surface of the platen, lower the bail bar to its original position
	Printhead too close to paper	Readjust printhead - refer to Printer Preparation chapter for procedure
Paper does not advance	Paper not loaded properly	Reload paper - refer to Printer Preparation chapter for procedure
	Paper release lever incorrectly set (roll paper only)	Press paper release lever toward back of the printer
	Feed holes torn	Reload paper - refer to Printer Preparation chapter for procedure
Multipart paper tears	Printhead too close to paper	Readjust printhead - refer to Printer Preparation chapter for procedure
	Paper not straight in printer	Realign paper stack within 1 cm (1/2 in) of tractors

Table 7-2 Operator Troubleshooting (Cont)

Indication	Possible Cause	Action
	Tractors incorrectly adjusted	Readjust right tractor
	Paper or printhead jam	Open access cover and clear jam, close access cover and press CLEAR FAULT key
Garbled or double characters	Incorrect communication set up	Verify that data communication switches are set to match the computer - refer to Communication chapter

MAINTENANCE

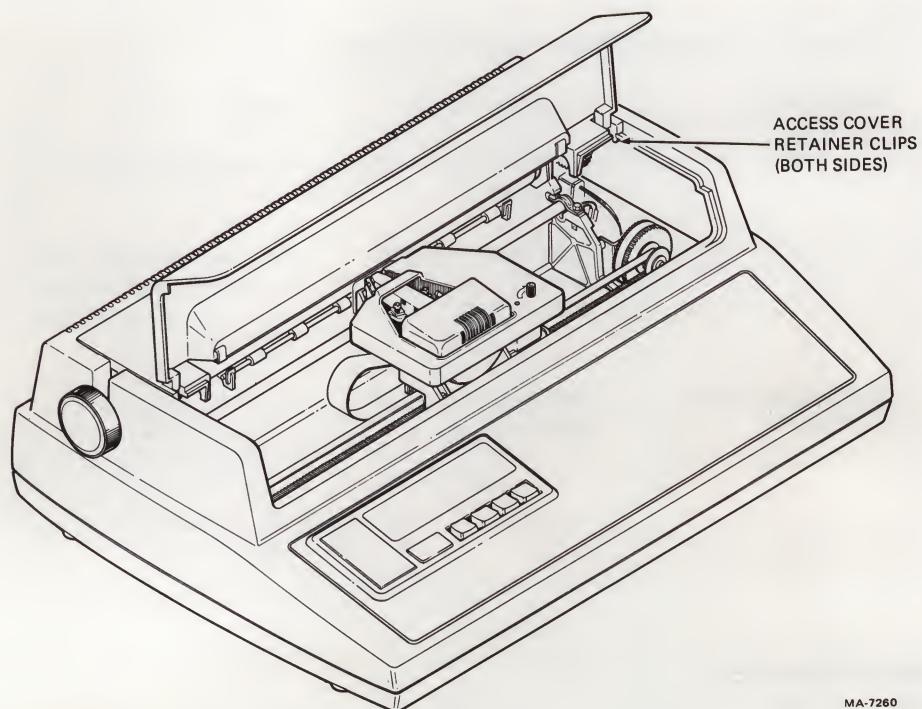
The DECwriter IV Graphic Printer requires no preventive maintenance by the user. Its surfaces and platen can only be cleaned with a damp cloth. Do not use cleaners with solvents or excessive amounts of water. Rubbing the keycaps with a dry or barely moist cloth is enough to clean them.

CAUTION: *Do not attempt to remove the keycaps to clean them more thoroughly. You can damage the switch contacts if the keycaps are replaced incorrectly.*

To remove the platen for cleaning, open the access cover, press the access cover retainer clips, and remove the access cover (Figure 7-5). Then lift the bail bar, press the platen release levers and lift the platen straight up (Figure 7-6). Clean the platen with a damp cloth, then replace it in its original position. The platen clicks into place when properly seated. Make sure the the platen rolls freely, then reinstall the access cover.

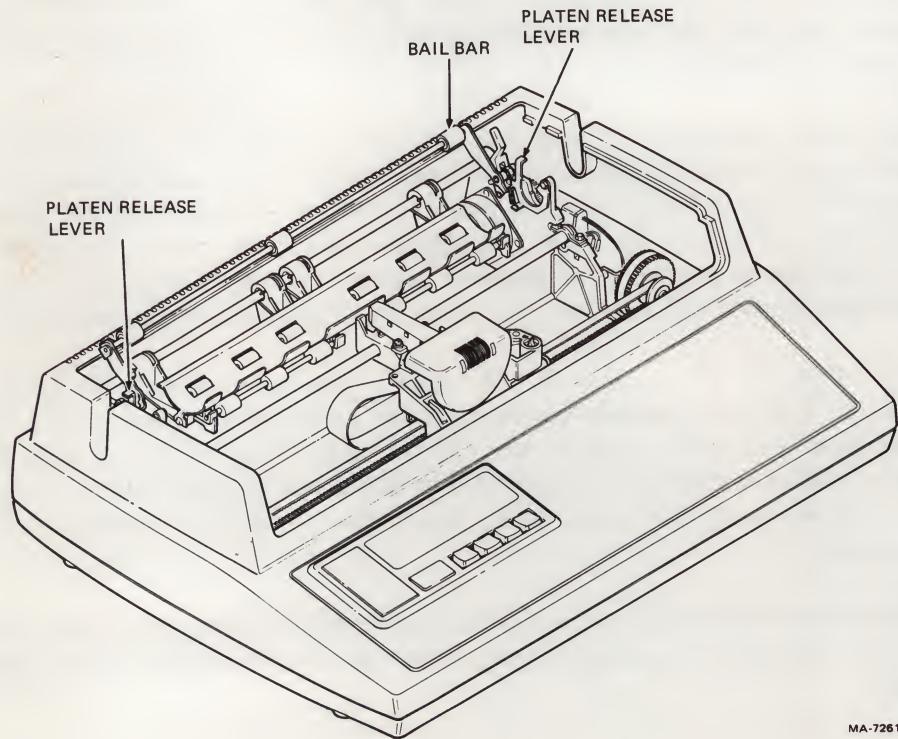
The DECwriter IV Graphic Printer covers are not meant to be weatherproof. There are several openings in the covers that liquids, coins, paper clips, and other objects can fall through. Such objects disturb the electronic operation of the printer if they come into contact with the circuitry. Therefore, do not place drinks and metal objects on any part of the terminal.

Keep the ventilation slots on the top and bottom of the printer clear. The printer overheats if you block these slots by placing objects on or under the it.



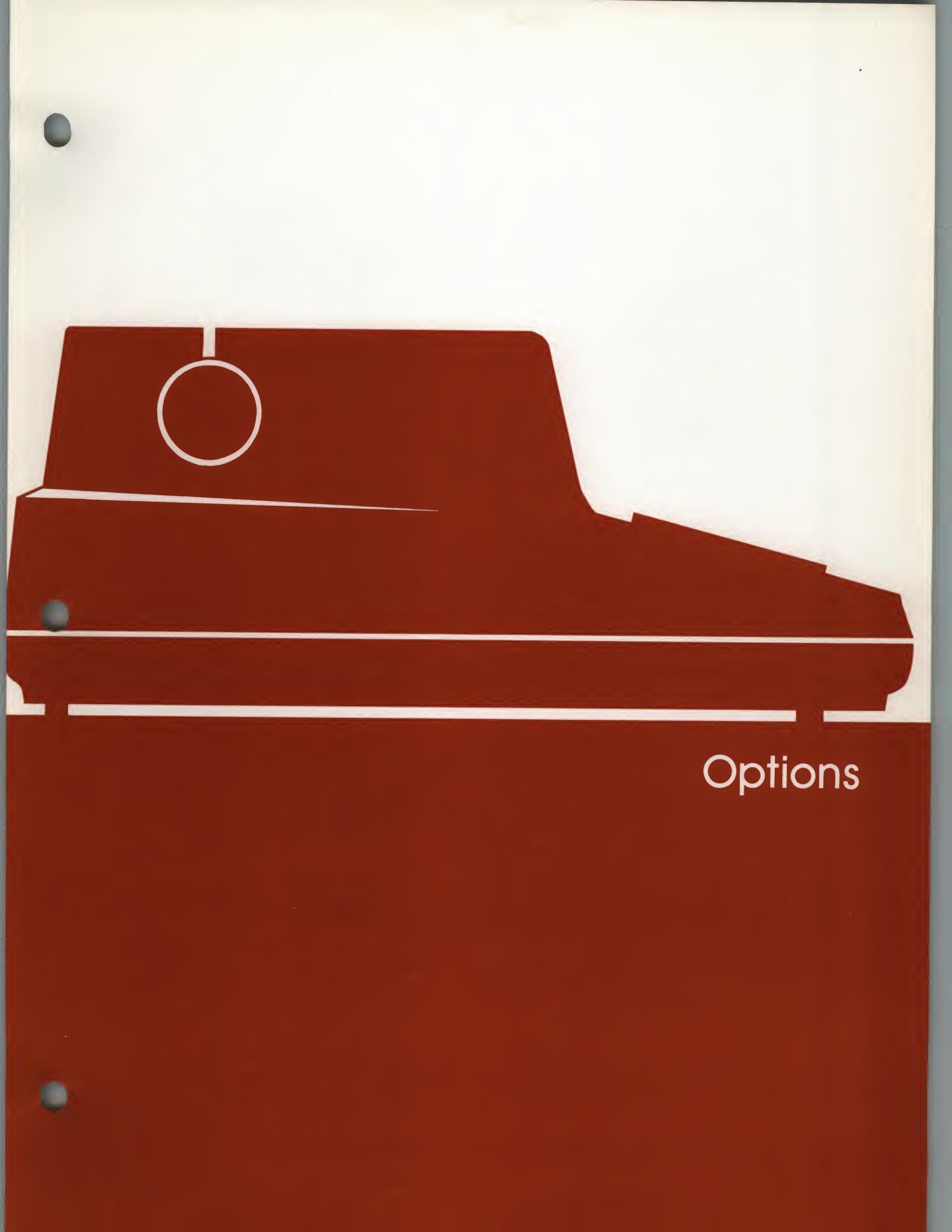
MA-7260

Figure 7-5 Access Cover Removal

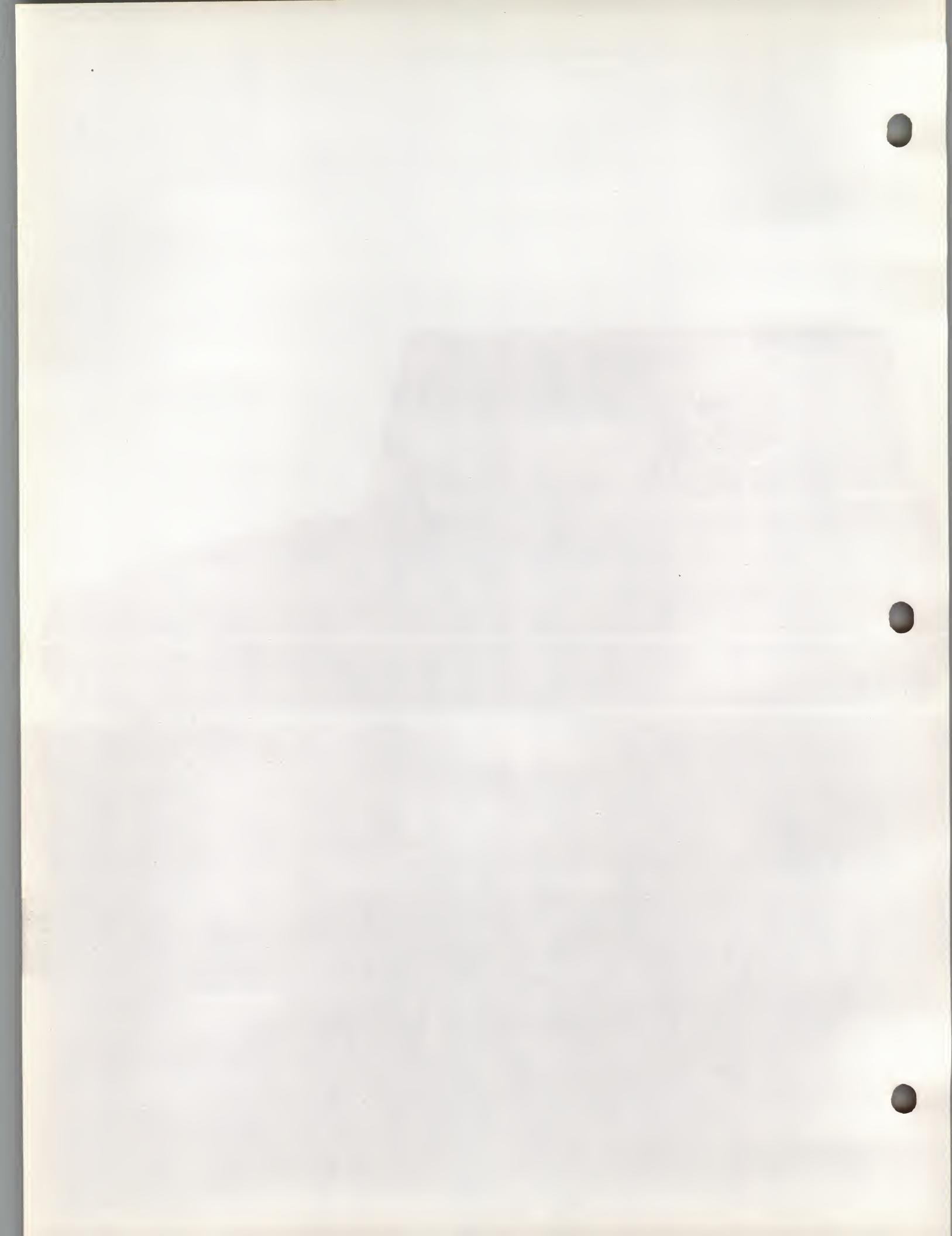


MA-7261

Figure 7-6 Platen Removal



Options



8

OPTIONS

GENERAL

The printer options are designed to enhance the basic terminal and make it useful in an even wider range of applications. The following paragraphs describe the options now available and the procedure used to install each option.

- LAX34-RL Roll Paper Holder Option
- LAX34-AL Tractor Option
- LAX34-SL Printer Stand Option
- LAX34-LL Paper Low Detection Option
- LAX34-PL Paper Out Detection Option
- LAX34-CL 20 mA Current Loop Option

LAX34-RL ROLL PAPER HOLDER OPTION

The roll paper holder option (LAX34-RL) allows DECwriter IV series terminals to be configured to accept roll paper up to 37.78 cm (14-7/8 in) in width.

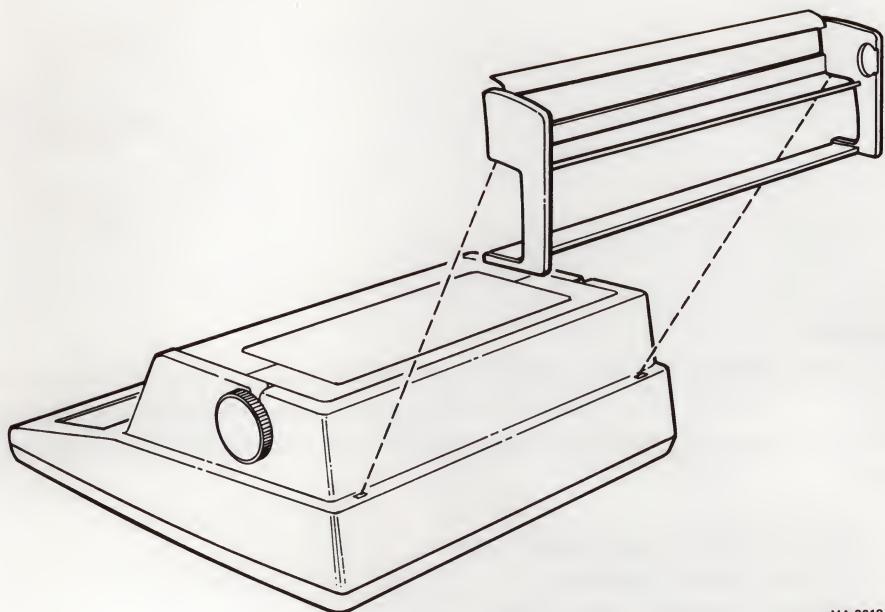
To install the roll paper holder, line up the notches on the holder with the corresponding holes in the back of the terminal (Figure 8-1). The roll paper holder is ready to be loaded with paper. Refer to the Printer Preparation chapter for paper loading information.

LAX34-AL TRACTOR OPTION

The tractor option (LAX34-AL) allows DECwriter IV series terminals to be configured to handle tractor feed paper in single or multipart forms.

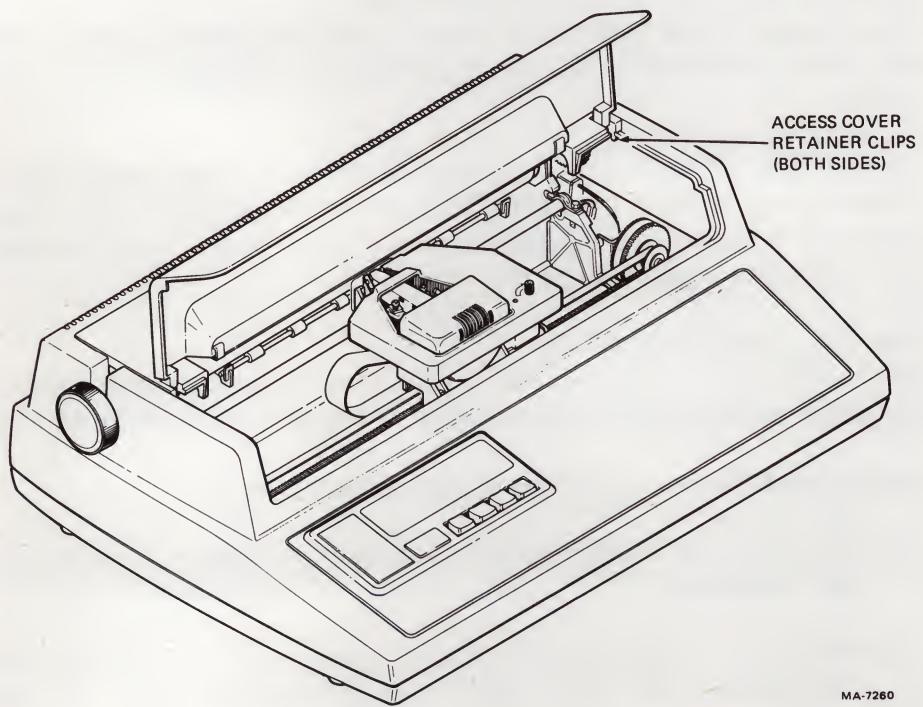
Perform the following procedure to install the tractor option.

1. Turn the power ON/OFF switch located at the rear of the terminal to the off position.
2. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time. Lift the cover straight up (Figure 8-2).
3. Locate and remove (pop out) the filler plugs from the access cover (Figure 8-3). This allows the tractor option to be attached to the platen drive gear.



MA-2618

Figure 8-1 Roll Paper Holder Information



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Figure 8-2 Access Cover Removal

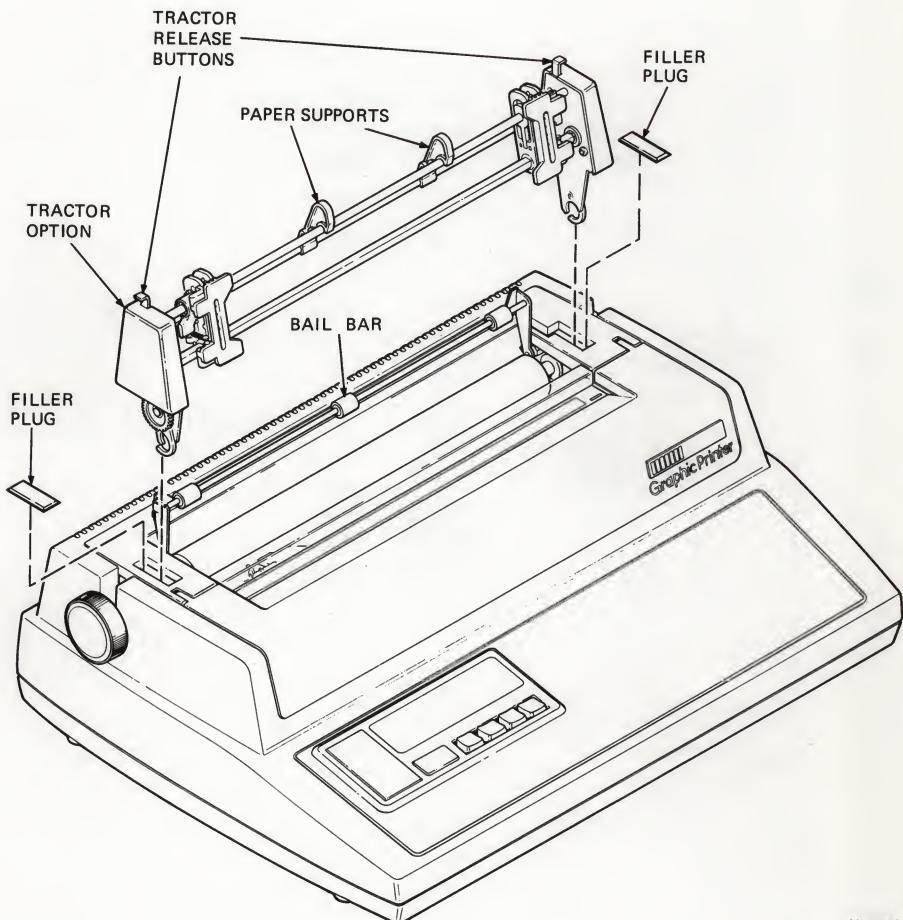
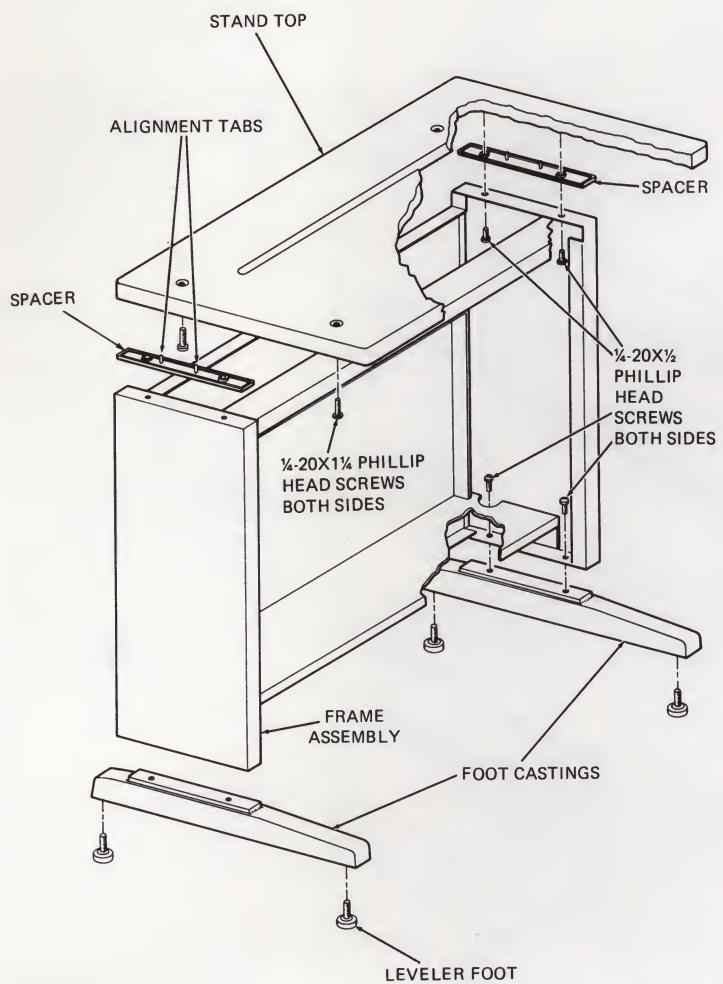


Figure 8-3 Tractor Option Installation

4. Reinstall the access cover by sliding the back edge of the cover under the lip in the printer housing, and pressing the access cover into its original position.
5. Lift the bail bar (Figure 8-3).
6. Press the left and right tractor release levers and position the tractor option into place on the platen assembly (Figure 8-3). Release the tractor release levers after the tractor assembly snaps into place.
7. The terminal is now ready to be loaded with paper. Refer to the Printer Preparation chapter for paper loading information.

LAX34-SL PRINTER STAND OPTION

The printer stand option LAX34-SL allows paper to be fed from the bottom of the terminal. In addition, the stand is a useful and attractive work surface for your terminal.



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Figure 8-4 Printer Stand Assembly (LAX34-SL)

The only tool required to assemble the printer stand is a #1 Phillips head screwdriver. To assemble the printer stand, refer to Figure 8-4 and perform the following procedure.

1. Attach the four leveler feet to the outermost tapped holes in the foot castings.
2. Secure the frame assembly to the foot castings using four Phillips head screws (#10 X 1/2).
3. Place the stand top upside down on a sheet of paper on the floor.
4. Place the spacers on the stand top. Make sure the alignment tabs on the spacers are in place as shown in Figure 8-4.
5. Secure the frame assembly to the stand top using four Phillips head screws (#10 X 1/2).

6. Return the printer stand to an upright position.
7. Secure the printer to the printer stand top using four Phillips head screws (1/4-20 X 1-1/4).
8. The printer is now ready to be loaded with paper. Refer to the Printer Preparation chapter for more paper loading information.

LAX34-LL PAPER LOW DETECTION OPTION

The paper low detection option LAX34-LL is designed to detect a paper low condition. A paper low condition occurs when the roll of paper is nearly empty. When a paper low condition occurs, the POWER/FAULT light flashes. The printer responds to a paper low condition by generating a preselected signal. The signal generated by the printer is determined by the data communication switch settings.

Perform the following procedure to install the paper low option. The tools required include #0 and #1 Phillips head screwdrivers and a small blade screwdriver.

1. Turn the power ON/OFF switch off. Disconnect the ac power cord from the wall receptacle and then the terminal.
2. Remove the paper and roll paper holder option.
3. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time. Lift the access cover straight up (Figure 8-2).
4. Remove the ribbon cartridge.
5. Lift the bail bar to gain access to the platen. Remove the platen by pressing the two platen release levers at the same time. Lift the platen straight up (Figure 8-5). Lower the bail bar to its original position.
6. With a small blade screwdriver, release the four snap fasteners that secure the printer housing cover to the base assembly. Remove the printer housing (Figure 8-6).
7. Press the bezel retainer clips and rotate the bezel towards the front of the terminal (Figure 8-7).
8. Remove the rear insert (Figure 8-8).
9. Locate the paper low jack and remove the attached nut and washer (Figure 8-8).
10. Insert the paper low jack through the rear insert and secure it using the nut and washer removed during the previous step (Figure 8-8).

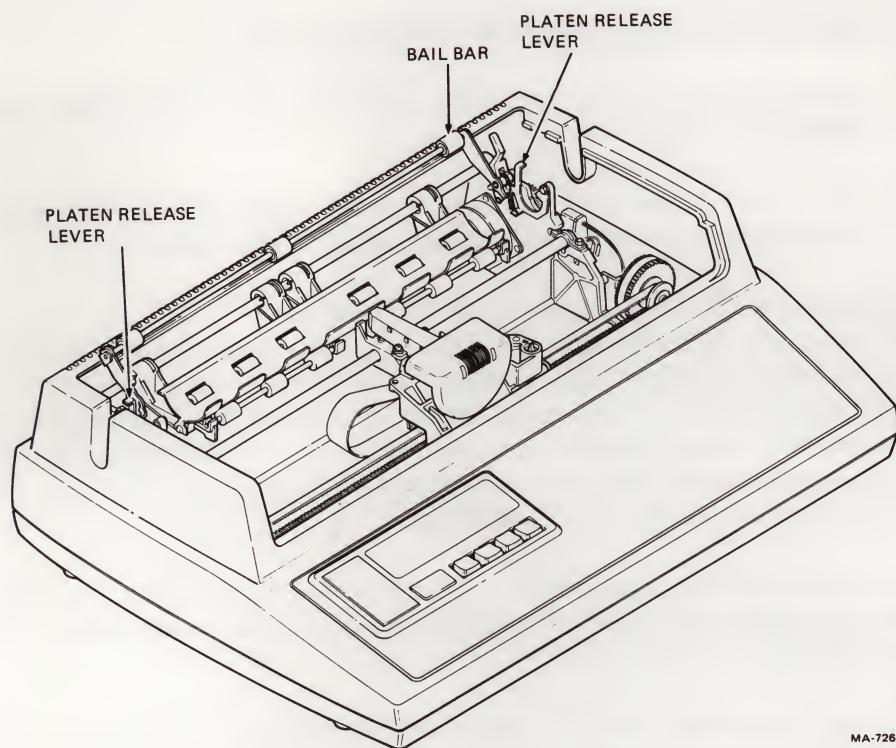


Figure 8-5 Platen Removal

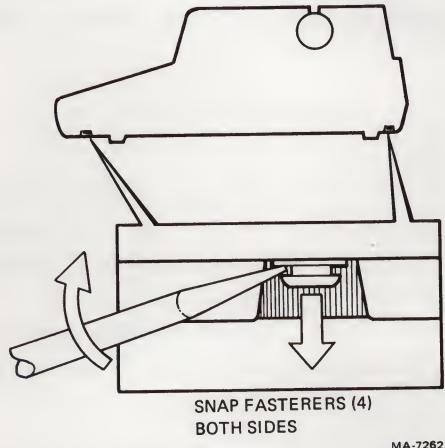


Figure 8-6 Printer Housing Removal

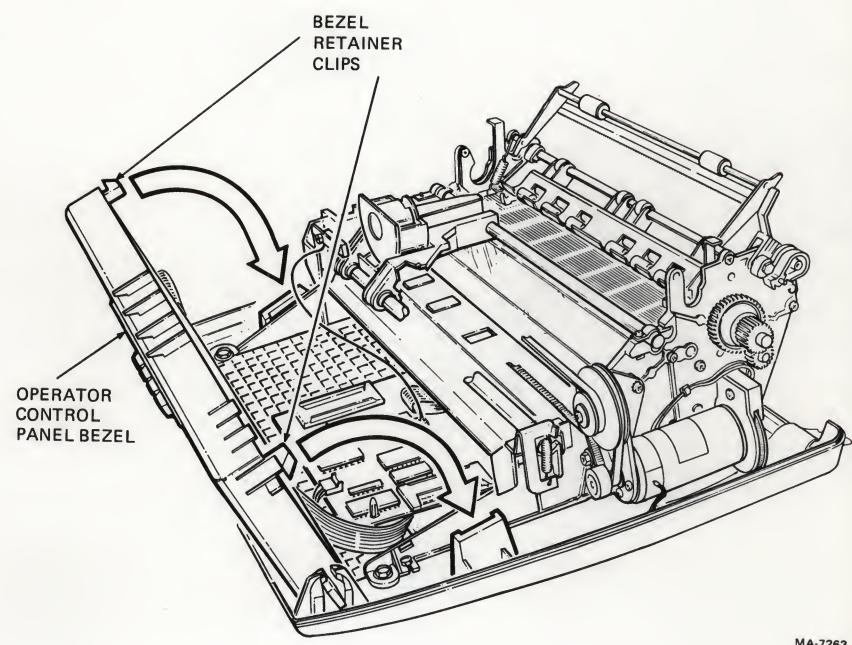


Figure 8-7 Operator Control Panel Bezel

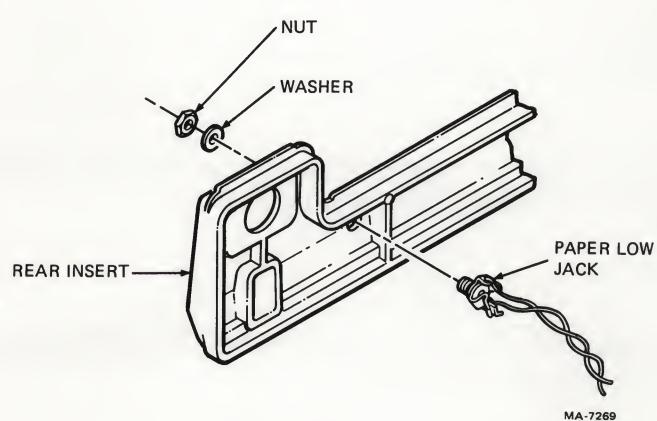


Figure 8-8 Attaching Paper Low Jack to Rear Insert

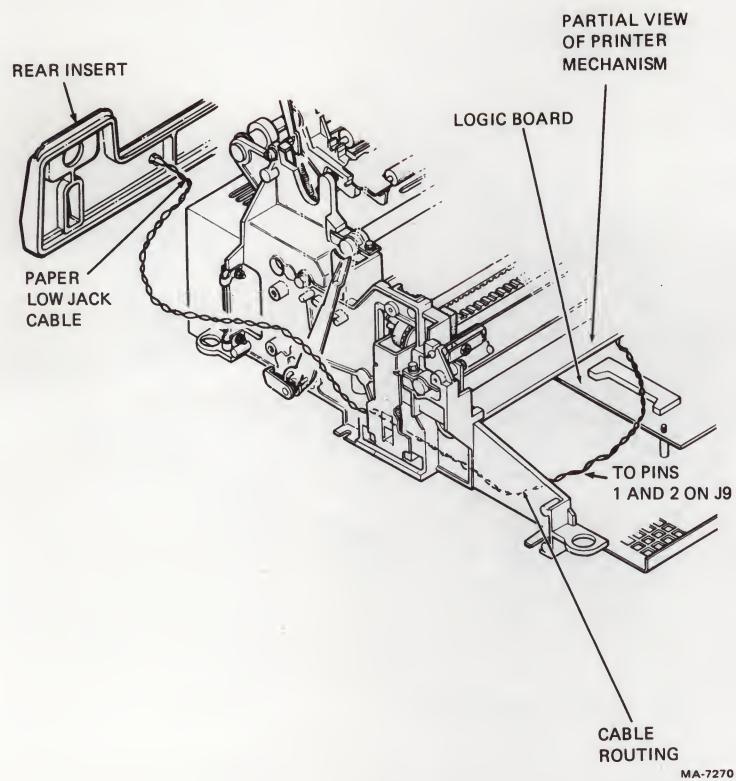


Figure 8-9 Paper Low Jack Cable Routing

11. Route the paper low cable connector around the printer mechanism and connect to J9 on the logic board (Figure 8-9).
12. Reinstall the rear insert.
13. Rotate the bezel forward to its original position and press the retainer clips to secure the bezel into place.
14. Replace the printer housing cover on the base assembly.
15. Secure the printer housing cover to the base assembly by pressing the four snap fasteners on the base assembly.
16. Reinstall the platen by lifting the bail bar and pressing the platen into place. Rotate the paper advance knob to verify that the gears are properly engaged. Lower the bail bar to its original position.
17. Slide the rear edge of the access cover under the lip in the printer housing and press the access cover back into its original position.
18. Reinstall the ribbon cartridge.

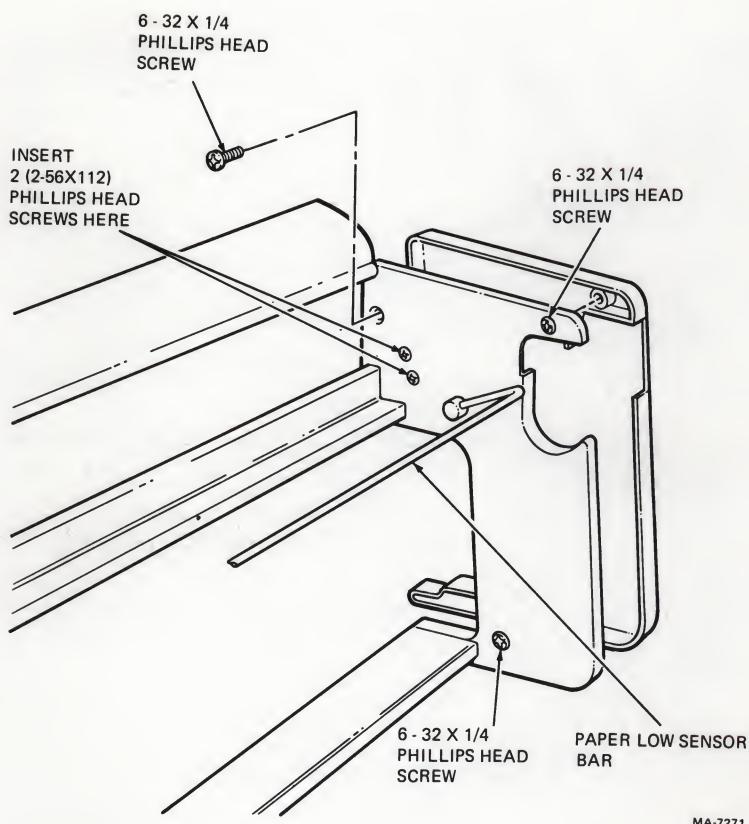


Figure 8-10 Roll Paper Holder Cover Cap

19. Using a #1 Phillips head screwdriver, remove the three Phillips head screws ($6\text{-}32 \times 1/4$) that secure the right roll paper cover cap (viewed from the back) to the roll paper holder. Set the cap aside (Figure 8-10).
20. Insert the two flat head Phillips screws ($2\text{-}56 \times 1/2$) through the inner side of roll paper holder (Figure 8-10).
21. Assert downward pressure on the paper low sensor bar shown in Figure 8-10 to open the cam assembly as shown in Figure 8-11.
22. With the paper low switch contact facing the cam, place the switch onto the two flat head Phillips screws ($2\text{-}56 \times 1/2$) inserted in the previous step. Then, release the paper low bar.
23. Secure the paper low switch using two tinnerman nuts (Figure 8-11).
24. Route the paper low jack cable through the paper holder assembly (Figure 8-11).
25. Reinstall the left roll paper cover cap.

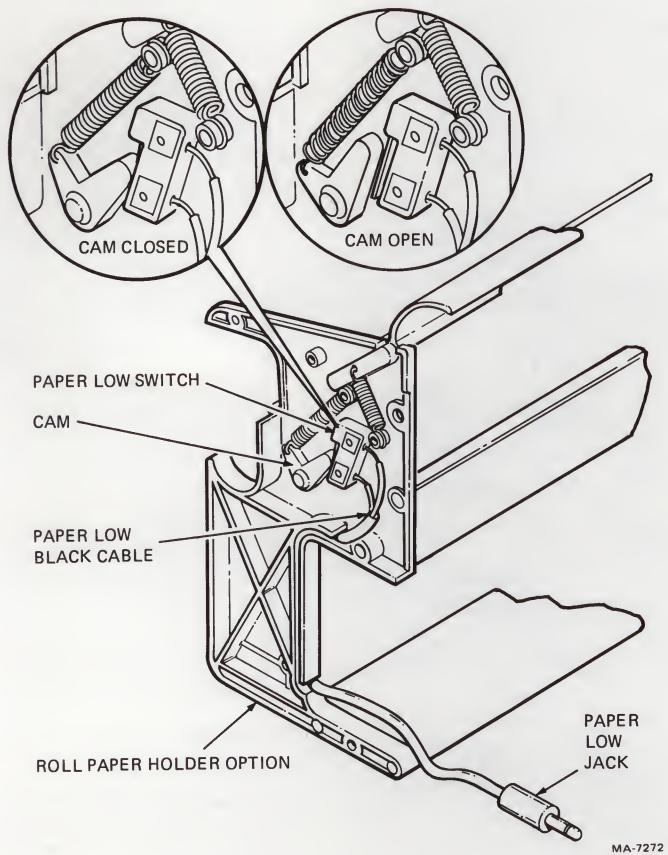


Figure 8-11 Paper Low Switch Installation

26. Reinstall the roll paper holder and paper.
27. Plug the paper low cable into the paper low jack on the rear insert.

NOTE: To override the paper low switch, disconnect the paper low cable from the paper low jack.

28. Set the data communication switches to the paper low position (refer to the Communication chapter for more detail on the data communication switches).
29. Plug the ac line cord into the rear of the terminal. Then plug the ac line cord into a nonswitched, three prong, grounded wall receptacle, and turn the power switch on.

LAX34-PL PAPER OUT DETECTION OPTION

The paper out detection option (LAX34-PL) is designed to detect a paper out condition. A paper out condition occurs when the physical edge of the last sheet of paper passes the paper out sensor. When a paper out condition occurs the POWER/FAULT light flashes and the printer responds by generating a preselected signal. The signal generated is determined by

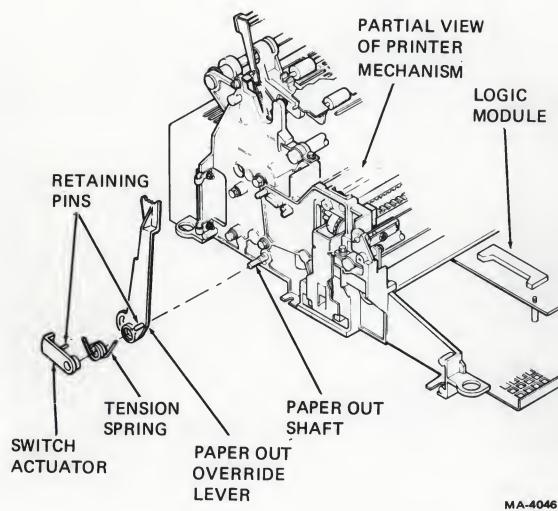


Figure 8-12 Installing the Paper Out Override Lever

the data communication switch settings (refer to the Communication chapter for more detail).

Perform the following procedure to install the paper out detection option. The tools required to perform the procedure include a #0 Phillips head screwdriver, a #1 Phillips head screwdriver, a small blade screwdriver, and a 1/4 inch open end wrench.

1. Turn the power ON/OFF switch off. Disconnect the ac power cord from the wall receptacle and then the terminal.
2. Remove the paper and tractor options.
3. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time. Lift the access cover straight up (Figure 8-2).
4. Remove the ribbon cartridge.
5. Lift the bail bar to gain access to the platen. Remove the platen by pressing the two platen release levers at the same time. Lift the platen straight up (Figure 8-5). Lower the bail bar to its original position.
6. With a small blade screwdriver, release the four snap fasteners that secure the printer housing cover to the base assembly. Remove the printer housing (Figure 8-6).
7. Press the bezel retainer clips and rotate the bezel towards the front of the terminal (Figure 8-7).
8. Press the paper out override lever onto the paper out shaft (Figure 8-12).

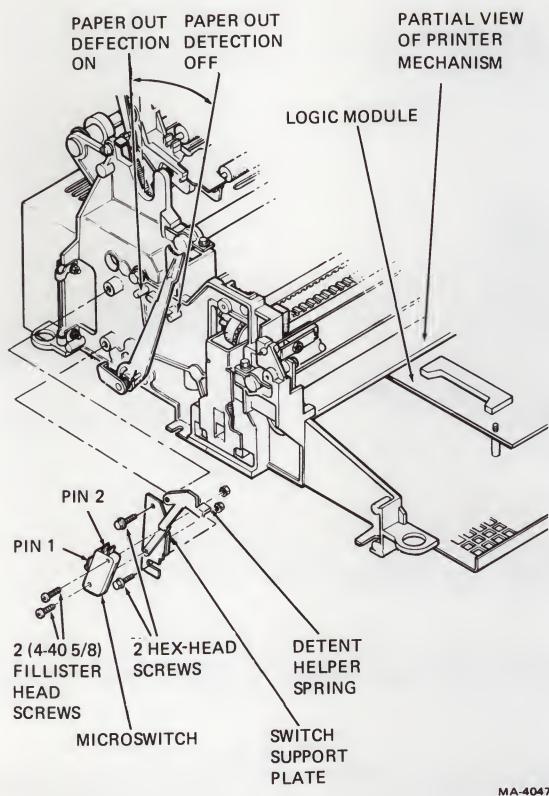


Figure 8-13 Installing the Paper Out Detection Switch

9. Spread the legs of the tension spring to increase spring tension. Place the spring on the switch actuator (Figure 8-12).
10. Press the switch actuator onto the paper out shaft. Make sure the spring is held in place between the retaining pins on the paper out override lever and the switch actuator (Figure 8-12).
11. Secure the microswitch and detent helper spring to the switch support plate using two 4-40 \times 5/8 fillister screws and two 4-40 kep nuts (Figure 8-13).
12. Using a 1/4 inch open end wrench, remove the top switch support plate hex-head screw and loosen the bottom switch support plate hex-head screw (Figure 8-13).
13. Slide the switch support plate assembly onto the bottom switch support plate hex head screw. Tighten the screw finger tight. Attach the top switch support plate hex head screw and tighten finger tight.

NOTE: The switch support plate must be adjusted before securing it to the printer mechanism.

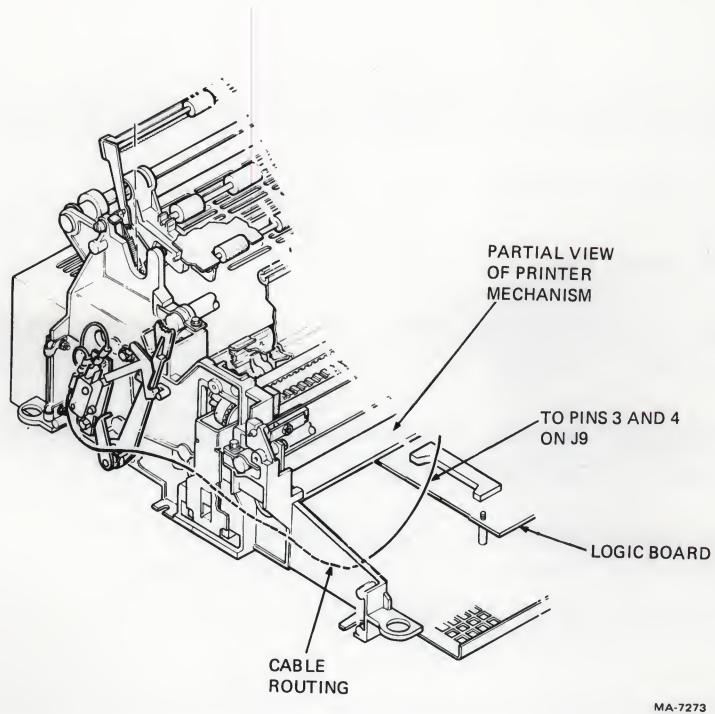


Figure 8-14 Paper Out Switch Cable Routing

14. With the paper out override lever in the paper out detection on position, adjust the switch support plate to activate (press) the microswitch. Using a 1/4 inch open end wrench, tighten the bottom switch support plate hex-head screw.

NOTE: When the paper out override lever is in the paper out detection on position, the paper out detection option will operate. When switched to the paper out detection off position, the paper out detection option will not operate.

15. Tighten the top switch support plate hex-head screw.
16. Connect the paper out cables to the microswitch and route the cables under the printer mechanism (Figure 8-14). Connect the cables to pins 3 and 4 of J9 on the logic board.
17. Rotate the bezel forward to its original position and press the retainer clips to secure the bezel in place.
18. Replace the printer housing cover on the base assembly.
19. Secure the printer housing cover to the base assembly by pressing the four snap fasteners on the base assembly.
20. Reinstall the platen by lifting the bail bar and pressing the platen into place. Rotate the paper advance knob to make sure the gears are properly engaged. Lower the bail bar to its original position.

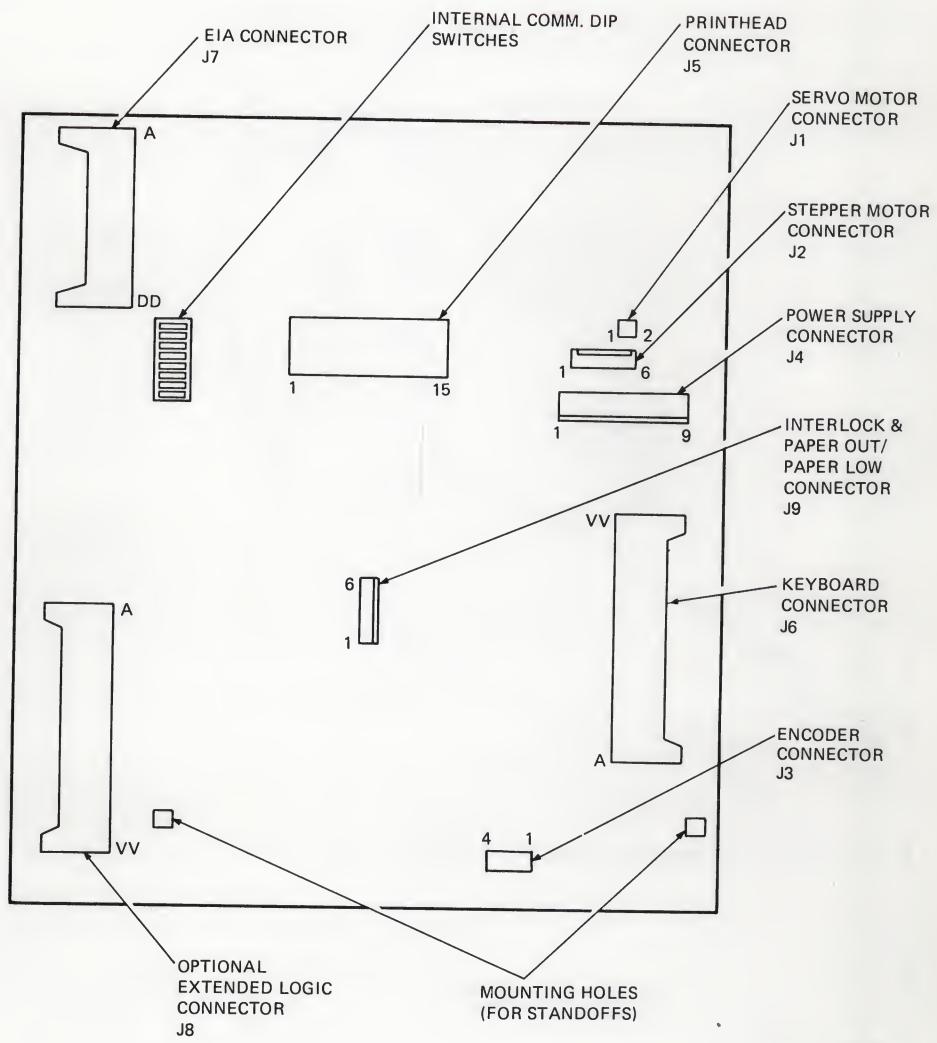
21. Slide the rear edge of the access cover under the lip in the printer housing and press the access cover back into its original position.
22. Reinstall the ribbon cartridge.
23. Reinstall the tractor option and paper.
24. Set the data communication switches to the correct settings (refer to the Communication chapter).
25. Plug the ac line cord into the rear of the terminal and then into a non-switched, three prong, grounded outlet.

LAX34-CL 20 mA CURRENT LOOP INTERFACE OPTION

The 20 mA current loop interface option allows the terminal to communicate with a computer up to 305 m (1000 ft) away without using a modem.

Perform the following procedure to install the 20 mA current loop option.

1. Turn the power ON/OFF switch at the rear of the terminal off and disconnect the ac line cord from the wall receptacle and then the terminal.
2. Remove the paper, and if installed, the roll paper holder or tractor options.
3. Remove the access cover by opening it and pressing the two access cover retainer clips at the same time. Lift the cover straight up (Figure 8-2).
4. Remove the ribbon cartridge.
5. Lift the bail bar to gain access to the platen. Remove the platen by pressing the two platen release levers at the same time. Lift the platen straight up (Figure 8-5). Lower the bail bar to its original position.
6. Use a small blade screwdriver to release the four snap fasteners that secure the printer housing to the base assembly (Figure 8-6). Remove the printer housing.
7. Press the bezel retainer clips and rotate the bezel towards the front of the terminal (Figure 8-7).
8. Remove the operator control panel connector from J6 on the logic board (Figure 8-15). Lift the bezel straight out.
9. Secure the shield wire on the 20 mA cable to the left side plate using existing hardware (Figure 8-16).



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Figure 8-15 Logic Board

10. Remove the option plug from the rear insert (Figure 8-17).
11. Insert the 20 mA cable connector through the hole now visible in the rear insert (Figure 8-17).
12. Attach the 20 mA cable connector to the mounting plug with two 6-32 slotted hex-head screws (Figure 8-17).
13. Attach the mounting plug to the rear insert with two 6-32 slotted hex-head screws (Figure 8-17).
14. Remove the logic board safety cover (Figure 8-18).
15. Disconnect the EIA interface connector from J7 on the logic board (Figure 8-15).

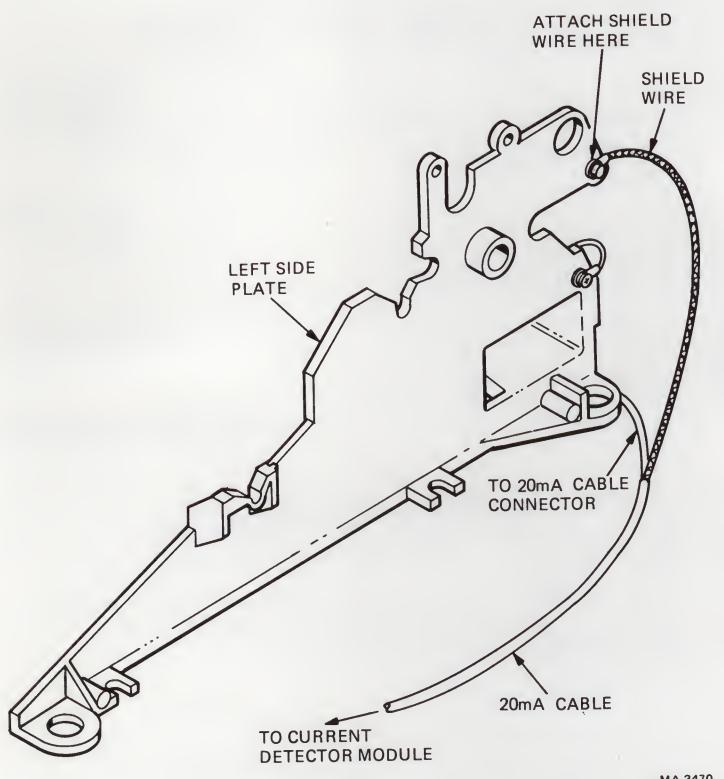


Figure 8-16 Attaching Shield Wire to Right Side Plate

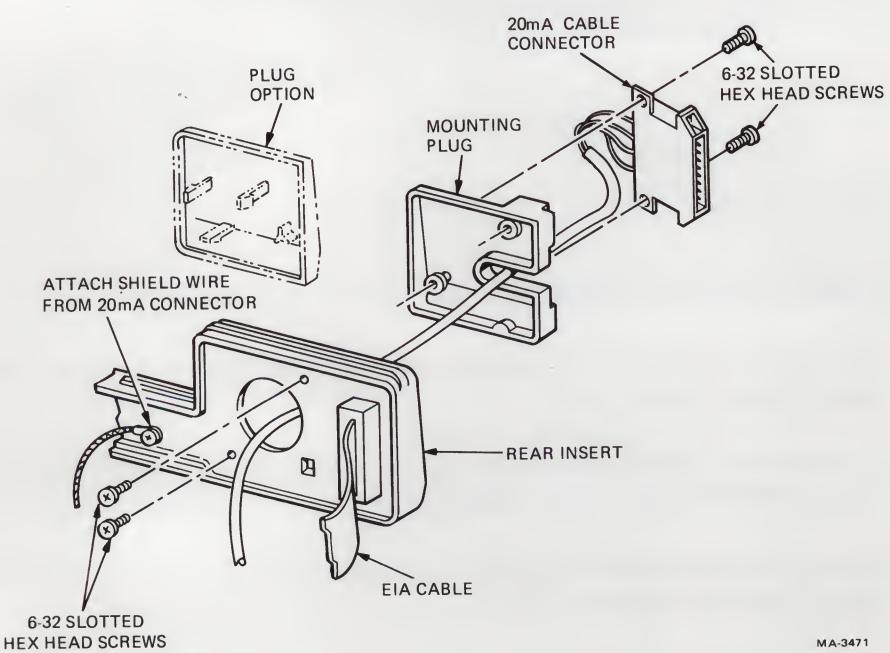


Figure 8-17 Attaching 20 mA Cable Connector to Rear Insert

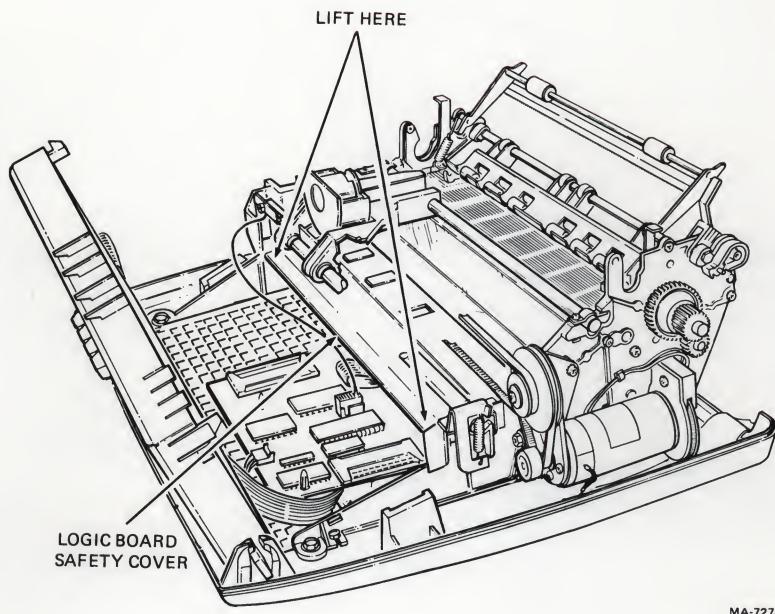
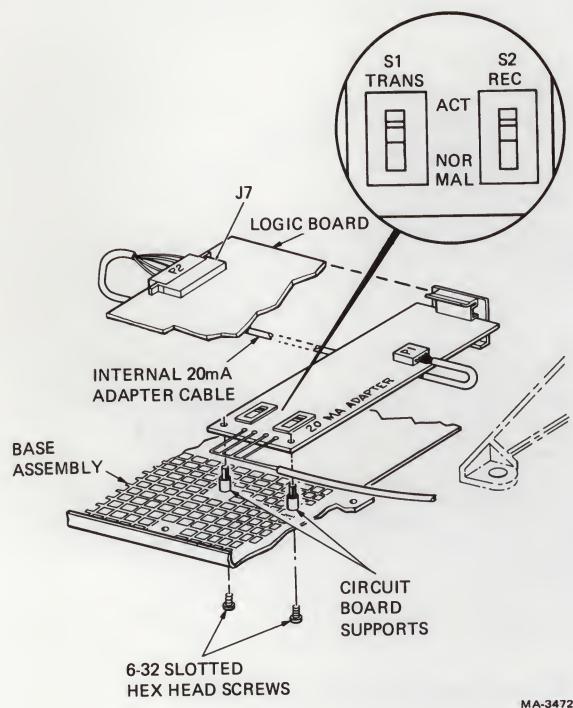


Figure 8-18 Logic Board Safety Cover Removal

16. Secure the circuit board supports to the base plate assembly with two 6-32 slotted hex-head screws (Figure 8-19).
17. Slide the rear edge of the current detector board into the lip in the rear of the printer mechanism. Then press the board onto the circuit board supports (Figure 8-19).
18. Connect P1 of the internal 20 mA adaptor cable to the current detector board (Figure 8-19).
19. Slide the internal 20 mA adaptor cable under the logic board and connect it to J7 on the logic board (Figure 8-19).
20. Set the TRANS and REC switches to the NORMAL position (Figure 8-19). If the terminal is to provide current to either the receive or transmit line, set the corresponding switch to ACT.

NOTE: To perform the data loopback test, set the TRANS and REC switches; one to NORMAL, one to ACTIVE.

21. Reinstall the logic board safety cover.
22. Return the bezel to the slots in the base assembly. Connect the operator control panel cable to J6 on the logic board.
23. Rotate the bezel back to its original position and press the bezel retainer clips to secure the bezel in place.



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Figure 8-19 20 mA Circuit Board Installation

24. Replace the printer housing cover on the base assembly. Secure the printer housing cover to base assembly by pressing the four snap fasteners on the base assembly.
25. Lift the bail bar to reinstall the platen. Press the platen into place. Rotate the paper advance knob to make sure the platen rolls freely. Lower the bail bar to its original position.
26. Slide the rear edge of the access cover under the lip in the printer housing and press the access cover back into its original position.
27. Reinstall the ribbon cartridge.
28. Reinstall the paper and roll paper holder or tractor options if necessary.
29. Plug the ac line cord into the rear of the terminal and then into a non-switched, three prong grounded outlet. Turn the power ON/OFF switch on.

Test After Installation

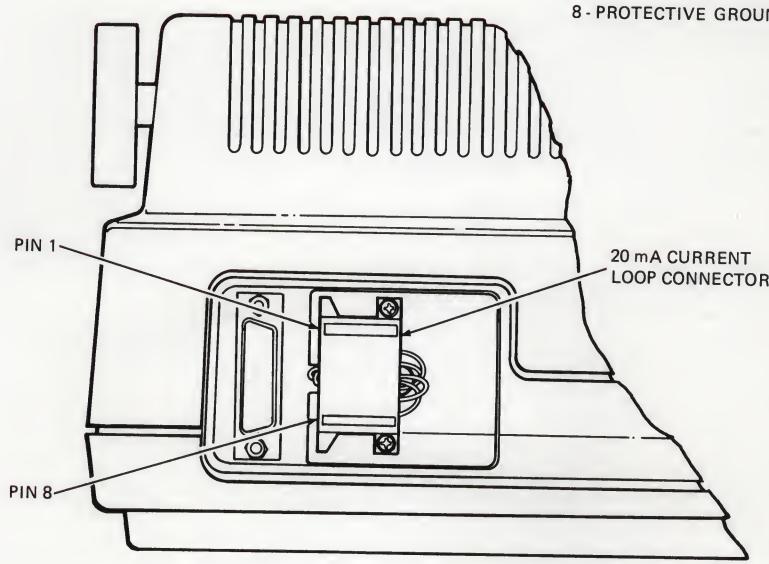
Perform the data loopback test described in the Testing and Troubleshooting chapter.

Table 8-1 20 mA Current Loop Electrical Characteristics

Transmitter	Min	Max	Receiver	Min	Max
Open circuit voltage	5.0 V	50 V	Voltage drop marking	-	2.5 V
Voltage drop marking	-	4.0 V	Spacing current	-	3.0 mA
Spacing current	-	2.0 mA	Marking current	15 mA	50 mA
Marking current	20 mA	50 mA			

PIN ASSIGNMENTS

- 1 - TEST NEGATIVE
- 2 - TRANSMIT-
- 3 - RECEIVE-
- 5 - TRANSMIT +
- 7 - RECEIVE +
- 8 - PROTECTIVE GROUND

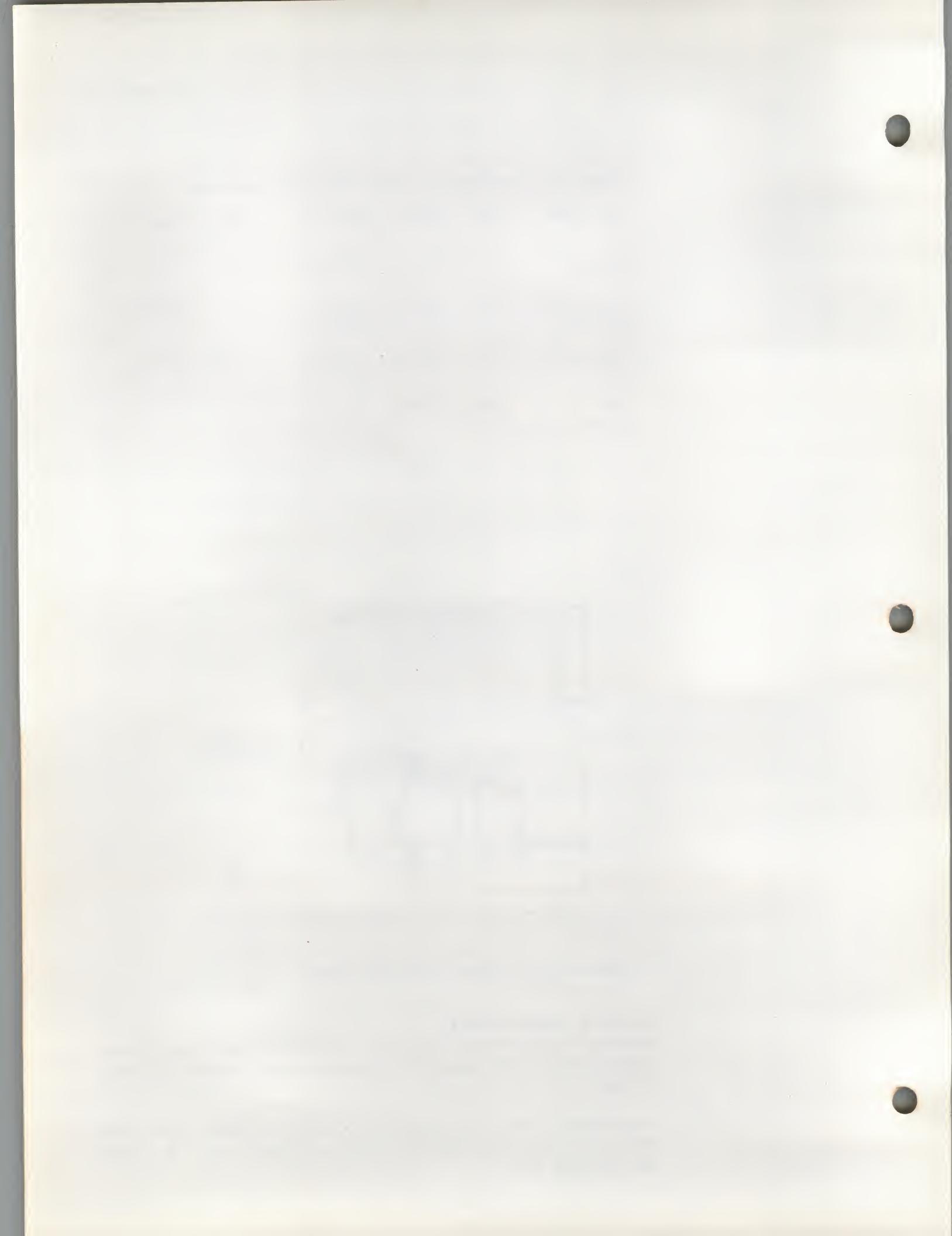


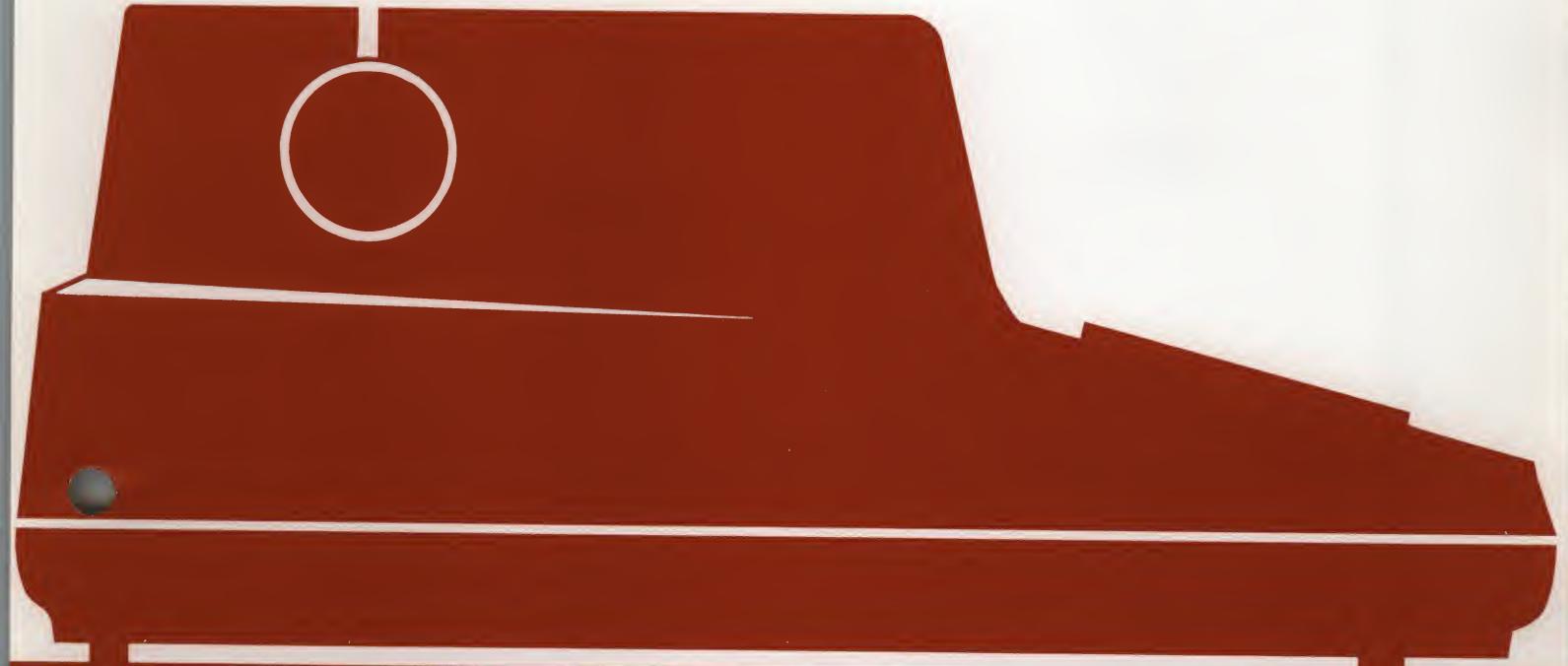
MA-7275

Figure 8-20 20 mA Interface Pin Assignments**Electrical Characteristics**

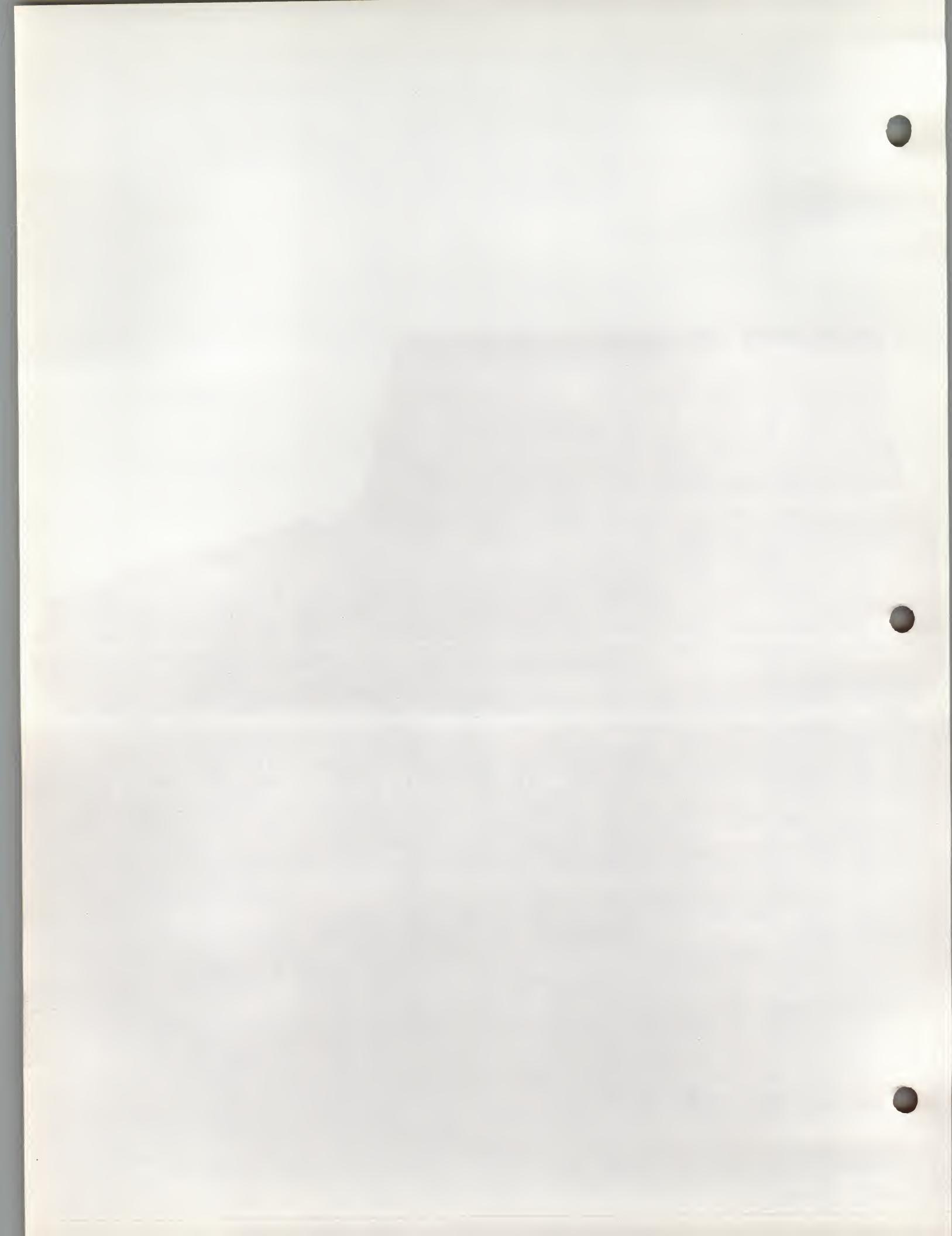
Electrical characteristics of the 20 mA current loop interface are shown in Table 8-1. Figure 8-20 shows the 20 mA current loop interface pin assignments.

In addition to these characteristics for normal operation, active mode places the transmitter or receiver in series with a source of $17 \text{ V} \pm 5$ percent and 660 ohms.





Accessories and Supplies

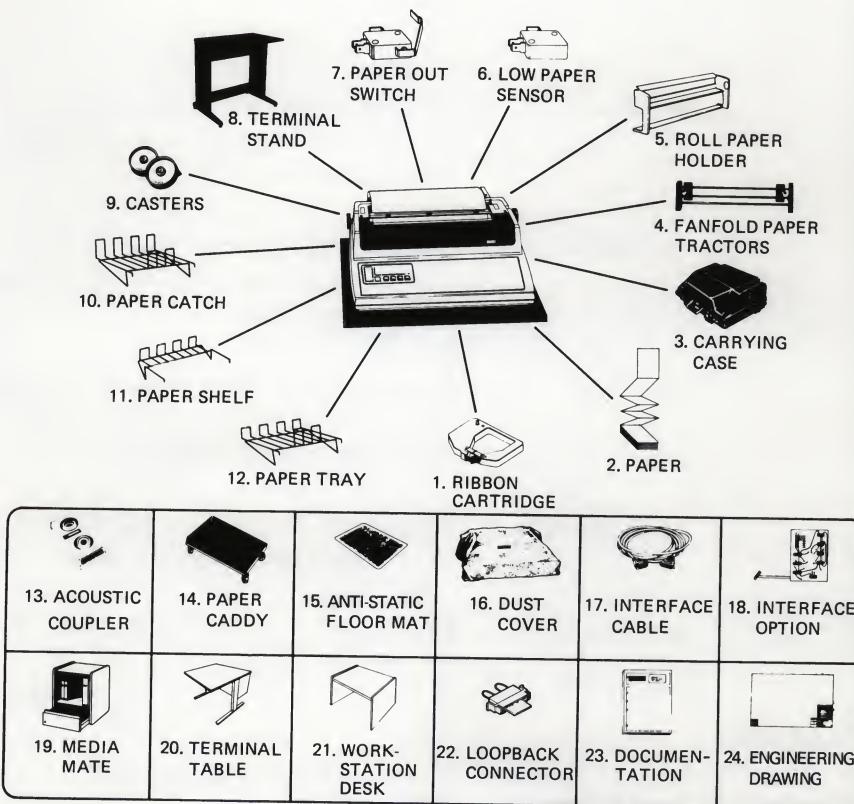


9

ACCESSORIES AND SUPPLIES

GENERAL

The DECwriter IV printers offer improved printing quality and forms handling. A wide variety of accessories and supplies are available to enhance printer versatility and make operation easier. The following paragraphs describe the DECwriter IV Graphic Printer accessories and supplies and the correct ordering information.



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SUPPLIES

Item Number	Part Number	Description
Ribbon Cartridges		
1	LA34R-03	DECwriter IV ribbon cartridge, one box of three ribbon cartridges
1	LA34-12	DECwriter IV ribbon cartridge, one box of 12 ribbon cartridges
1	LA34R-A4	DECwriter IV ribbon cartridge, 12 dozen
1	LA34R-H2	DECwriter IV ribbon cartridge, 60 dozen
Paper		
2	36-05361	Fanfold paper, white, gray lined, 8-1/2 × 11 inches (21.6 × 27.9 cm), 3200 sheets/box
2	36-09829	Fanfold paper, white, gray lined, 9-7/8 × 11 inches (25.1 × 27.9 cm), 3200 sheets/box
2	36-09141	Fanfold paper, white with green bars, 14-7/8 × 11 inches (37.8 × 27.9 cm), 2400 sheets/box
2	36-05365-01	Roll paper, 8-1/2 × 4-1/2 inches (21.6 cm × 11.4 cm), 12/box
2	36-16611-01	Roll paper, 14-1/2 × 3 inches (36.8 × 7.6 cm), 10/box

ACCESSORIES

Item Number	Part Number	Description
3	LAX34-ZA	Portable carrying case for DECwriter IV terminal (also room for cables, fanfold paper, and either an acoustic coupler/modem or LAX34-AL paper tractors, 9 1/4 inches high × 24 inches wide × 19 inches deep).
4	LAX34-AL	Fanfold paper tractors

Item Number	Part Number	Description
5	LAX34-RL	Roll paper holder
6	LAX34-LL	Paper low detection option
7	LAX34-PL	Paper out detection option
8	LAX34-SL	Terminal stand
9	LAX34-SM	Terminal stand casters (set of two)
10	LAX34-SP	Wireform paper catch for LAX34-SL
11	LAX34-SQ	Wireform paper shelf for LAX34-SL
12	LAX34-SW	Wireform paper tray for DECwriter IV printers
13	DF01-A	Acoustic telephone coupler, 300 baud
14	M9850-FA	Paper caddy with four 2-inch swivel casters for transporting printer paper, 15 3/4 inches wide × 11 3/4 inches deep.
15	H9850-DA	Anti-static floor mat, DECmat, 4 × 6 feet (1.22 × 1.83 m), Driftwood color (brownish gray)
15	H9850-DB	Anti-static floor mat, DECmat, 4 × 6 feet (1.22 × 1.83 m), summer earth color (brown/gold)
15	H9850-DC	Anti-static floor mat, DECmat, 3 × 10 feet (.91 × 3.05 m), silver birch color (orange/brown)
15	H9850-DD	Anti-static floor mat, DECmat, 3 × 10 feet (.91 × 3.05 m), autumn bronze color (orange/brown)
15	H9850-DE	Anti-static floor mat, DECmat, 3 × 10 feet (.91 × 3.05 m), driftwood
15	H9850-DF	Anti-static floor mat, DECmat, 4 × 6 feet (1.22 × 1.83 m), silver birch color (silvergray/brown)

Item Number	Part Number	Description
15	H9850-DH	Anti-static floor mat, DECmat, 4 × 6 feet (1.22 × 1.83 m), autumn bronze color (orange/brown)
16	H9850-HA	Heavy gauge vinyl dust cover (roll paper holder option)
16	H9850-HB	Heavy gauge vinyl dust cover (tractor option)
17	BC22A-10	EIA RS232 female-female shielded null modem cable, 10 feet (3.0 m)
17	BC22A-25	EIA RS232 female-female null modem cable, 25 feet (7.6 m)
17	BC23A-10	Kit of five BC22A-10
17	BC23A-25	Kit of five BC22A-25

NOTE: EIA RS-232-C specifies a maximum cable length of no more than fifty feet. The 20 mA current loop interface option is recommended for null modem configurations of more than fifty feet.

17	BC03M-A0	Female-female null modem cable, 100 feet (30.5 m)
17	BC03M-B5	Female-female null modem cable, 250 feet (76.2 m)
17	BC03M-E0	Female-female null modem cable, 500 feet (152.4 m)
17	BC03M-L0	Female-female null modem cable, 1000 feet (304.8 m)
17	BC22B-10	EIA RS232 male-female shielded extension cable, 10 feet (3.0 m)
17	BC22B-25	EIA RS232 male-female shielded extension cable, 25 feet (7.6 m)
17	BC23B-10	Kit of five BC22B-10
17	BC23B-25	Kit of five BC22B-25
17	BC05X-15	20 mA current loop extension cable, 15 feet (4.6 m)

Item Number	Part Number	Description
17	BC05X-25	20 mA current loop extension cable, 25 feet (7.6 m)
17	BC05X-50	20 mA current loop extension cable (50 feet (15.2 m))
17	30-10958-02	DF01-A acoustic telephone coupler interface cable
18	LAX34-CL	20 mA interface option and cable
19	H9850-AP	Media mate shelf or file storage cart with casters and lockable drawer, 25-1/4 inches high X 15 inches deep X 18-1/2 inches wide (64.1 X 38.1 X 47.0 cm)
20	H970-EB	Terminal table, 27 inches high X 36 inches wide X 30 inches deep (68.6 X 91.4 X 76.2 cm) with levelers
20	H970-HB	Terminal table, 27 inches high X 24 inches wide X 30 inches deep (68.6 X 61.0 X 76.2 cm) with levelers
21	H9532-AA	Work-station desk with blue front panel and gray side panels, levelers, 48 inches wide X 30 inches high X 30 inches deep (122 X 76.2 X 76.2 cm)
21	H9532-AB	Work-station desk with brown front panel and brown side panels, levelers, 48 inches wide X 30 inches high X 30 inches deep (122 X 76.2 X 76.2 cm)

LOOPBACK CONNECTORS

Item Number	Part Number	Description
22	12-15336	EIA
22	70-18353	20 mA

DOCUMENTATION

Item Number	Part Number	Description
23	EK-LA34S-PS	DECwriter IV Series Pocket Service Guide
23	EK-L34RO-UG	DECwriter IV Graphic Printer User Guide
23	EK-LA34S-TM	DECwriter IV Series Technical Manual
23	EK-OLA34-IP	LA34 Illustrated Parts Breakdown
24	MP 01090	LA34 RA Engineering Drawings
24	MP 01091	LA34 VA Engineering Drawings
24	MP 0109	LA34 WA Engineering Drawings

SPARES KITS

Item Number	Part Number	Description
	SLA34-RO	DECwriter IV Graphic Printer spares kit (advance sale)

ORDERING INFORMATION**Continental USA**

Call 800-258-1710, or mail order to:

Digital Equipment Corporation
 P.O. Box CS2008
 Nashua, NH 03061

Alaska or Hawaii

Call 408-734-4915, or mail order to:

Digital Equipment Corporation
 632 Caribbean Drive
 Sunnyvale, CA 94086

New Hampshire

Call 603-884-6660, or mail order to:

Digital Equipment Corporation
 P.O. Box CS2008
 Nashua, NH 03061

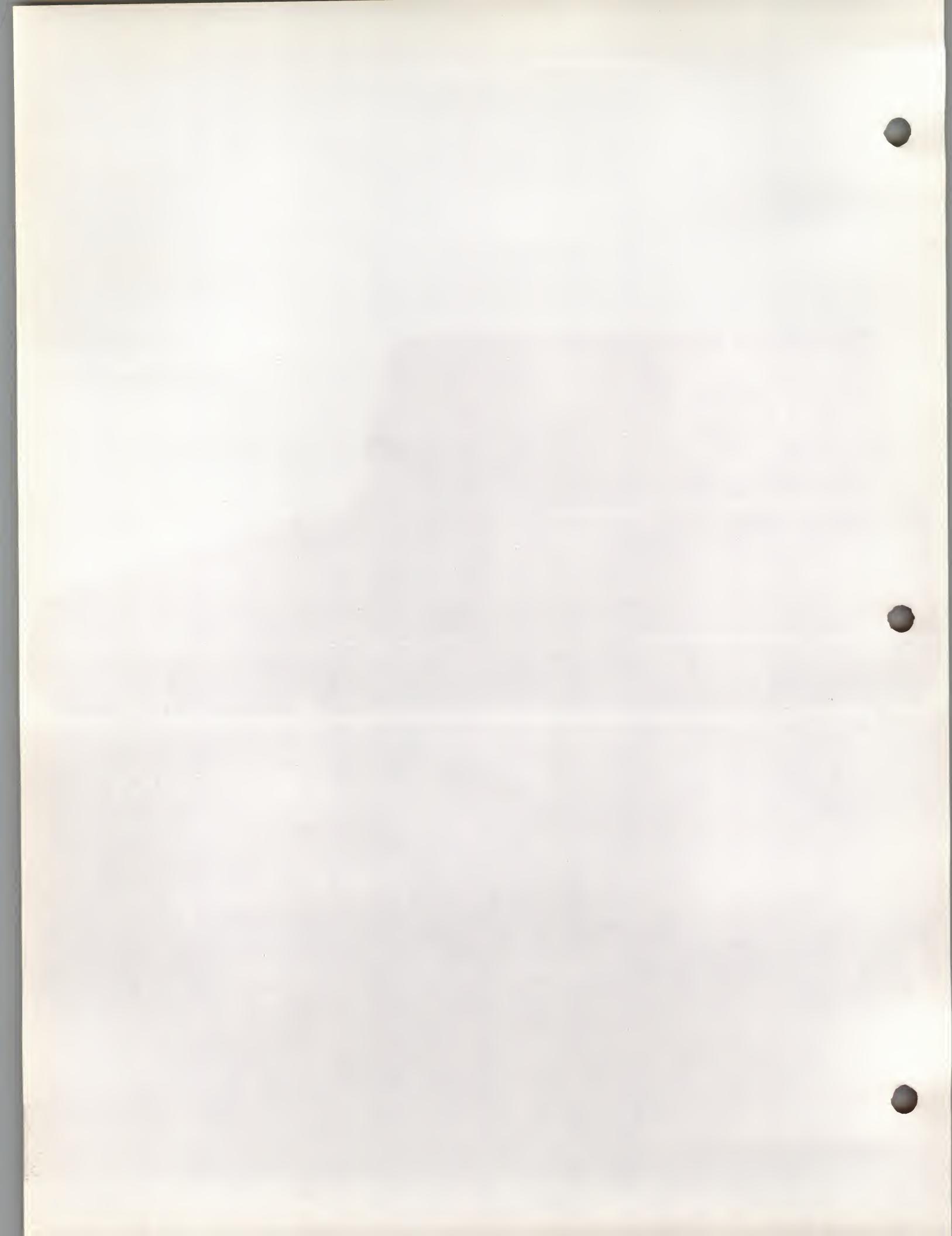
Canada

Call 800-267-6146, or mail order to:

Digital Equipment of Canada LTD.
 P.O. Box 13000
 Kanata, Ontario, Canada K2K 2A6

Att: A & SG Business Manager
 Telex: 610-562-8732

Appendices



APPENDIX A SPECIFICATIONS

OPERATING CHARACTERISTICS

Printing technique	Impact dot matrix
Print matrix	7 dots high by 9 dots wide
Maximum print rate	
Text mode	45 characters per second
Graphic mode	320 columns per second or 960 dots per second
Graphic mode horizontal resolution	132 columns per inch with a fifty percent overlap
Graphic mode vertical resolution	72 dots per inch with no overlap between dots, 4/9 of a dot overlap between lines
Aspect ratio	1.83
<i>NOTE: Aspect ratio is the ratio of the horizontal resolution to the vertical resolution.</i>	
Horizontal slew rate	45 inches per second
Single line feed time	70 ms
Vertical slew rate	5 inches per second
Paper feed	Pin feed, tractor drive Friction feed, platen drive
Vertical pitch (computer selected)	2, 3, 4, 6, 8, or 12 lines per inch
Horizontal pitch (computer selected)	10, 12, 13.2, 16.5, 5, 6, 6.6, 8.25 characters per inch

Maximum line length (varies with horizontal pitch)	10 characters per inch 132 columns 12 characters per inch 158 columns 13.2 characters per inch 168 columns 16.5 characters per inch 216 columns 5 characters per inch 66 columns 6 characters per inch 79 columns 6.6 characters per inch 84 columns 8.25 characters per inch 108 columns
Margins (computer selected)	Left, right, top, bottom
Tabs (computer selected)	216 horizontal 168 vertical
Character sets (computer selected)	USASCII United Kingdom Finland Norway/Denmark Sweden Germany French Canadian France VT100 compatible
Other printer features	Cover open interlock, self test, status message, auto last character view
Operator Control Panel Features	On-line, off-line, self-test, top of form, form feed

PHYSICAL CHARACTERISTICS

Dimensions	
Length	55.9 cm (22 in)
Width	16.4 cm (16.4 in)
Height	18.3 cm (6.5 in)
Terminal weight	10 kg (22 lbs)
Power	90-128 Vac
Voltage	180-256 Vac
Switch selectable	
W maximum printing	45 watts
W maximum nonprinting	25 watts

Temperature	
Operating	10° to 40° C (50 to 104° F), non-condensing
Nonoperating	-40° to 66° C (-40° to 151° F), noncondensing
 Relative Humidity	
Operating	10 to 90% with a maximum wet bulb temperature of 28° C (82° F) and minimum dew point of 2° C (36° F), noncondensing
Nonoperating	5 to 95%, noncondensing

PAPER REQUIREMENTS

Roll Feed

Width	7.62 to 37.78 cm (3 to 14 7/8 in)
Weight	
Single-part	6.8 kg (15 lb) paper minimum
Roll diameter	4 1/2 inch maximum
Core diameter	1 inch

NOTES

1. *Single sheet or roll paper can be used.*
2. *Roll feed preprinted forms are not recommended.*
3. *Multipart forms are not recommended.*
4. *Impact paper is not recommended.*
5. *Card stock is not recommended.*

Tractor Feed

Width	7.62 to 37.78 cm (3 to 14 7/8 in)
Weight	
Single-part	6.8 kg (15 lb) paper minimum 0.25 mm (0.010 in) thick card stock maximum
Multipart	one to four parts (refer to the following notes) 0.50 mm (0.020 in) thick, maximum

NOTES

1. *Multipart forms can have only one card part; the card must be the last part.*
2. *First-surface impact paper is not recommended.*
3. *Dot or line glue margins are acceptable (if the line is on one margin only).*
4. *Split forms (forms with each side containing a different number of sheets) are not recommended.*
5. *Stapled forms are not recommended.*

RIBBON SPECIFICATION**Cartridge Dimensions**

Length	10.64 cm (4.188 in)
Width	14.15 cm (5.570 in)
Height	1.42 cm \pm .051 cm (.560 in \pm .2 in)

Ribbon Fabric

Material	Nylon, non-textured
Thickness	.086 - .1076 mm (.0034 - .0042 in)
Width	1.27 \pm .0381 cm
Ribbon Life	12 hours continuous printing

APPENDIX B

TEXT MODE CONTROL FUNCTION SUMMARY

GENERAL

This appendix is a summary of the text mode printable and control characters. It also includes a summary of the escape and control sequences.

TEXT MODE CONTROL CHARACTERS

Table B-1 lists the text mode control characters to which the DECwriter IV Graphic Printer responds.

Table B-1 Text Mode ANSI Control Characters

Name	Mnemonic	Octal Code	Function
Null	NUL	000	No operation (not stored in the input buffer) used as fill characters (refer to Communication chapter)
Bell	BEL	007	Sounds audible bell tone
Backspace	BS	010	Moves active column left one column unless active column is at left margin - this condition causes no action (active column and active line described later in this chapter)
Line feed	LF	012	Advances active line one line or to top margin of next page if active line is at the bottom margin - active column also set to left margin if line feed new line mode is on
Vertical tab	VT	013	Advances active line to next vertical tab stop or top margin of next page if there are no more tabs on page, line feed new line mode does not affect this character

Table B-1 Text Mode ANSI Control Characters (Cont)

Name	Mnemonic	Octal Code	Function
Form feed	FF	014	Advances active line to top margin of next page, line feed new line mode does not affect this character
Carriage return	CR	015	Returns active column to left margin
Shift out	SO	016	Switches the graphic printer to G1 printable character set
Shift in	SI	017	Switches the graphic printer to G0 printable character set
Cancel	CAN	030	Immediately ends any control or escape sequence
Substitute	SUB	032	Immediately ends any control or escape sequence, any character received with errors are replaced by the SUB character, SUB characters printed as ☰
Escape	ESC	033	Interpreted as introducer of an escape sequence
Delete	DEL	177	No operation (not stored in the input buffer)

SEQUENCE SUMMARY**Line Feed New Line Mode**

Name	Mnemonic	Sequence					
Line feed new line mode	LNM	ESC	[	2	0	h	
		033	133	062	060	150	
		ESC	[	2	0	I	
		033	133	062	060	154	

Character Sets

Name	Mnemonic	G0 Designator			G1 Designator		
United Kingdom	SCS	ESC	(	A	ESC	)	A
		033	050	101	033	051	101

Name	Mnemonic	G0 Designator			G1 Designator		
USASCII		ESC	(	B	ESC	)	B
		033	050	102	033	051	102
Finland		ESC	(	C	ESC	)	C
		033	050	103	033	051	103
Norway/ Denmark		ESC	(	E	ESC	)	E
		033	050	105	033	051	105
Sweden		ESC	(	H	ESC	)	H
		033	050	110	033	051	110
Germany		ESC	(	K	ESC	)	K
		033	050	113	033	051	113
French Canadian		ESC	(	Q	ESC	)	Q
		033	050	121	033	051	121
France		ESC	(	R	ESC	)	R
		033	050	122	033	051	122
VT100 compatible		ESC	(	0	ESC	)	0
		033	050	060	033	051	060

*NOTE: The *** character is used to indicate variable numeric parameters within the octal representation of the control or escape sequence.*

Active Column and Active Line

Name	Mnemonic	Sequence			
Index	IND	ESC	D		
		033	104		
Vertical position absolute	VPA	ESC	[	Pn	d
		033	133	***	144
Next line	NEL	ESC	E		
		033	105		
Horizontal position absolute	HPA	ESC	[	Pn	\
		033	133	***	140
Horizontal position relative	HPR	ESC	[	Pn	a
		033	133	***	141
Cursor up	CUU	ESC	[	Pn	A
		033	133	***	101

Name	Mnemonic	Sequence			Pn	e
Vertical position relative	VPR	ESC 033	[133		***	145
Partial line down	PLD	ESC 033	K 113			
Partial line up	PLU	ESC 033	L 114			
Reverse index index	RI	ESC 033	M 115			

Horizontal Pitch (Characters Per Inch)

Name	Mnemonic	Sequence		
Set horizontal pitch	DECSHORP	ESC 033	[133	0 060 w 167
(10 char/in)		ESC 033	[133	1 061 w 167
(12 char/in)		ESC 033	[133	2 062 w 167
(13.2 char/in)		ESC 033	[133	3 063 w 167
(16.5 char/in)		ESC 033	[133	4 064 w 167
(5 char/in)		ESC 033	[133	5 065 w 167
(6 char/in)		ESC 033	[133	6 066 w 167
(6.6 char/in)		ESC 033	[133	7 066 w 167
(8.25 char/in)		ESC 033	[133	8 070 w 167

Horizontal Margins

Name	Mnemonic	Sequence						
Set left and right margins	DECSLRM	ESC 033	[133	Pn ***	;	Pn 073	***	s 163

Horizontal Tabs

Name	Mnemonic	Sequence						
Horizontal tabulation set	HTS	ESC 033	H 110					
Horizontal tabulation set	DECHTS	ESC 033	1 061					
Tabulation clear	TBC	ESC 033	[133	0 060	g 147			
Tabulation clear	TBC	ESC 033	[133	2 062	g 147			
Tabulation clear	TBC	ESC 033	[133	3 063	g 147			
Clear all horizontal tabs	DECCAHT	ESC 033	2 062					
Set horizontal tabs	DECSHTS	ESC 033	[133	Pn ***	;	... 073	... ***	u 165

Vertical Pitch (Lines Per Inch)

Name	Mnemonic	Sequence						
Set vertical pitch	DECVERP	ESC 033	[133	0 060	z 172			
(6 lines/in)								
(6 lines/in)		ESC 033	[133	1 061	z 172			
(8 lines/in)		ESC 033	[133	2 062	z 172			

Name	Mnemonic	Sequence			
(12 lines/in)		ESC 033	[133	3 063	z 172
(2 lines/in)		ESC 033	[133	4 064	z 172
(3 lines/in)		ESC 033	[133	5 065	z 172
(4 lines/in)		ESC 033	[133	6 066	z 172

Form Length

Name	Mnemonic	Sequence			
Set lines per physical page	DECSDLPP	ESC 033	[133	Pn ***	t 164

Vertical Margins

Name	Mnemonic	Sequence			
Set top, bottom margins	DECSTBM	ESC 033	[133	Pn ***	; 073 Pn *** r 162

Vertical Tabs

Name	Mnemonic	Sequence			
Vertical tab set	VTS	ESC 033	J 112		
Vertical tab set	DECVTS	ESC 033	3 063		
Set vertical tab stops	DECSVTS	ESC 033	[133	Pn ***	; 073 ... Pn *** v 166
Tabulation clear	TBC	ESC 033	[133	1 061	g 147
Tabulation clear	TBC	ESC 033	[133	4 064	g 147

Name	Mnemonic	Sequence
Clear all vertical tabs	DECCAVT	ESC 4 033 064

Product Identification

Name	Mnemonic	Sequence
Device attributes	DA	ESC [c 033 133 143
Device attributes	DA	ESC [0 c 033 133 060 143
Identify terminal	DECID	ESC Z 033 132

APPENDIX C

GRAPHIC MODE PRINTABLE CHARACTER SUMMARY

Table C-1 contains the graphic mode printable characters, and the dot column definitions for each character.

Table C-1 Printable Character Dot Column Definitions (Graphic Mode)

Character	Octal Value	Wires Fired	Character	Octal Value	Wires Fired
?	077	o	D	104	•
		o			o
		o			•
		o			o
		o			o
		o			o
@	100	•	E	105	o
		o			•
		o			•
		o			o
		o			o
		o			o
A	101	o	F	106	•
		•			•
		o			•
		o			o
		o			o
		o			o
B	102	•	G	107	o
		•			o
		o			o
		o			•
		o			o
		o			o
C	103	o	H	110	•
		o			o
		•			o
		o			•
		o			o
		o			o

• = dot o = no dot

**Table C-1 Printable Character Dot Column Definitions (Graphic Mode)
(Cont)**

Character	Octal Value	Wires Fired	Character	Octal Value	Wires Fired
I	111	o ● o ● o o	P	120	● o o o ● o
J	112	● ● o ● o o	Q	121	o ● o o ● o
K	113	o o ● ● o o	R	122	● ● o o ● o
L	114	● o ● ● o o	S	123	o o ● o ● o
M	115	o ● ● ● o o	T	124	● o ● o ● o
N	116	● ● ● ● o o	U	125	o ● ● o ● o
O	117	o o o o ● o	V	126	● ● o ● ● o

● = dot o = no dot

**Table C-1 Printable Character Dot Column Definitions (Graphic Mode)
(Cont)**

Character	Octal Value	Wires Fired	Character	Octal Value	Wires Fired
W	127	o o o ● ● o	• ↑	136	● ● ● ● ● o
X	130	● o o ● ● o	- ←	137	o o o o o ●
Y	131	o ● o ● ● o	◦ ↘	140	● o o o o ●
Z	132	● ● o ● ● o	a	141	o ● o o o ●
[	133	o o ● ● ● o	b	142	● ● o o o ●
\	134	● o ● ● ● o	c	143	o o ● o o ●
]	135	o ● ● ● ● o	d	144	● o ● o o ●

● = dot o = no dot

**Table C-1 Printable Character Dot Column Definitions (Graphic Mode)
(Cont)**

Character	Octal Value	Wires Fired	Character	Octal Value	Wires Fired
e	145	o ● ● o o ●	l	154	● o ● ● o ●
f	146	● ● ● o o ●	m	155	o ● ● ● o ●
g	147	o o o ● o ●	n	156	● ● ● o ●
h	150	● o o ● o ●	o	157	o o o o ● ●
i	151	o ● o ● o ●	p	160	● o o o ● ●
j	152	● ● o ● o ●	q	161	o ● o o ● ●
k	153	o o ● ● o ●	r	162	● ● o o ● ●

● = dot o = no dot

**Table C-1 Printable Character Dot Column Definitions (Graphic Mode)
(Cont)**

Character	Octal Value	Wires Fired	Character	Octal Value	Wires Fired
s	163	o o ● o ● ●	y	171	o ● o ● ● ●
t	164	● o ● o ● ●	z	172	● ● o ● ● ●
u	165	o ● ● o ● ●	{	173	o o ● ● ● ●
v	166	● ● ● o ● ●	|	174	● o ● ● ● ●
w	167	o o o ● ● ●	}	175	o ● ● ● ● ●
x	170	● o o ● ● ●	~	176	● ● ● ● ● ●

● = dot o = no dot

APPENDIX D OTHER TERMINALS

GENERAL

The terminal is a vital link between the user and the power of the computer. Often the right terminal, or the right enhancement to your terminal, can make your work easier, more efficient, or more cost effective. For that reason, DIGITAL offers a full range of video and printer terminals and options that can help you tackle any application.

PRINTER TERMINALS

DIGITAL's printer terminals are noted for their strength and reliability, selectable baud rates, and multiple user-selectable features, that provide all the flexibility you need to efficiently configure your work stations.

DECwriter III

DIGITAL's LA120 DECwriter III is the performance terminal for high-speed communications. At 180 characters per second the DECwriter III boosts throughput by combining bidirectional smart printing and a 100-character buffer with fast horizontal and vertical skipping over white space. The LA120 also offers the convenience and flexibility of more than 45 keyboard-selectable features. These features include variable font sizes, tabs, form lengths, and many other time saving features previously available only as options. Mnemonic commands, prompting LED display, a special decal, and a convenient pocket-sized operator card all make the LA120 easy to set up and use.

A selectable baud rate (up to 9600) along with automatic self-test diagnostics give you the performance and reliability characteristics you look for in a high-speed communications terminal.

DECwriter IV

DIGITAL continues to develop new technology and better terminals with functional specifications our customers demand. The new DECwriter IV is the latest in small convenient printers. It comes in two models, both light and compact enough to be easily transported to the most convenient work station for maximum efficiency. The LA34 is the desk-top model with designer appearance and typewriter-like keyboard. It is smaller, lighter, and quieter than many typewriters. The easy-to-change ribbon cartridge, roll-feed paper, and convenient keyboard-selectable features - like four character-width adjustments - make this terminal simple enough for anyone to use.

The LA38 comes with tractor feed for multipart forms and includes roll feed for standard paper. A numeric keypad is standard for fast input of accounting data.

The DECwriter IV terminals include standard features such as microprocessor control, true 30 characters per second throughput, up to 9600 baud rate, and DECwriter reliability. These features give you all the performance you need in a convenient size package.

VIDEO TERMINALS

DIGITAL's video display terminals offer unmatched convenience and capabilities with features designed to give you performance you would expect from much more expensive and complex equipment.

VT100

The VT100 is DIGITAL's high-performance video display terminal. It offers a combination of features never before available on a compact desk-top terminal. It is both affordable and easy to use. It has also proved to be one of the most popular and imitated video terminals. The VT100 offers you maximum video display flexibility. The sculptured typewriter-like keyboard permits easy transition from typewriter to terminal.

Operator-oriented features include 80- or 132-column lines, double width/double height characters, detachable keyboard, smooth scrolling, split-screen display, and composite video output. These features allow users to customize the video terminal to suit specific applications.

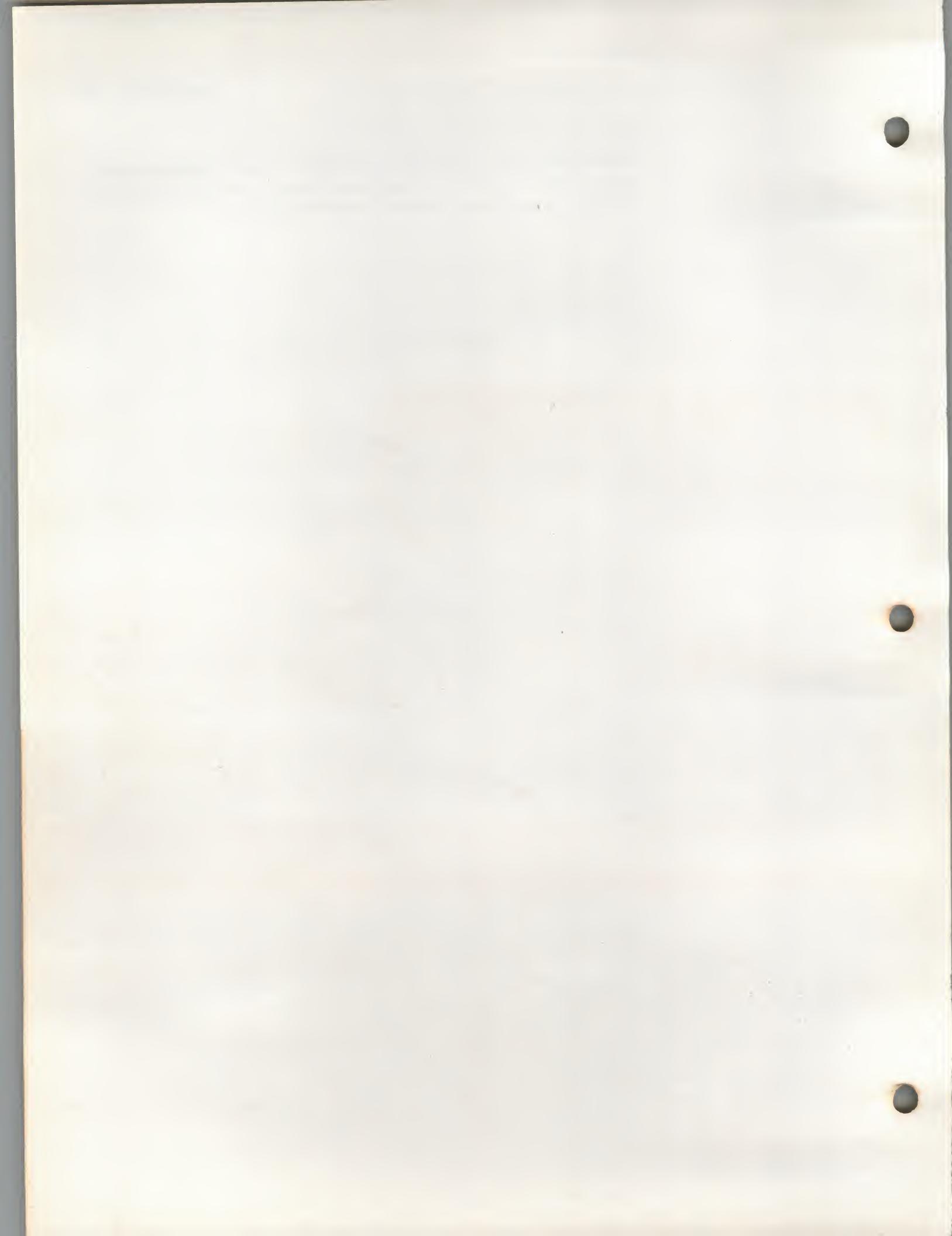
INTELLIGENT VIDEO TERMINALS

At the head of the VT100 class is DIGITAL's intelligent PDT-11/150 terminal. The PDT-11/150 with its PDP-11 compatible processor and RT-11 operating system, permits you to draw on a wide range of existing software.

The PDT-11/150 series of intelligent terminals are small standalone business systems in a terminal package. They can put executives in touch with every part of the company, as the intelligent node in a network, or can operate as a personal independent computer. Mass storage in the PDT-11/150 is in floppy disk form. The PDT-11/150 includes three system expansion ports for adding up to three terminals, making it a powerful remote workstation. Any of DIGITAL's LA series of printers can also be connected to the second port for hardcopy capability. The third port provides an EIA link to a host computer.

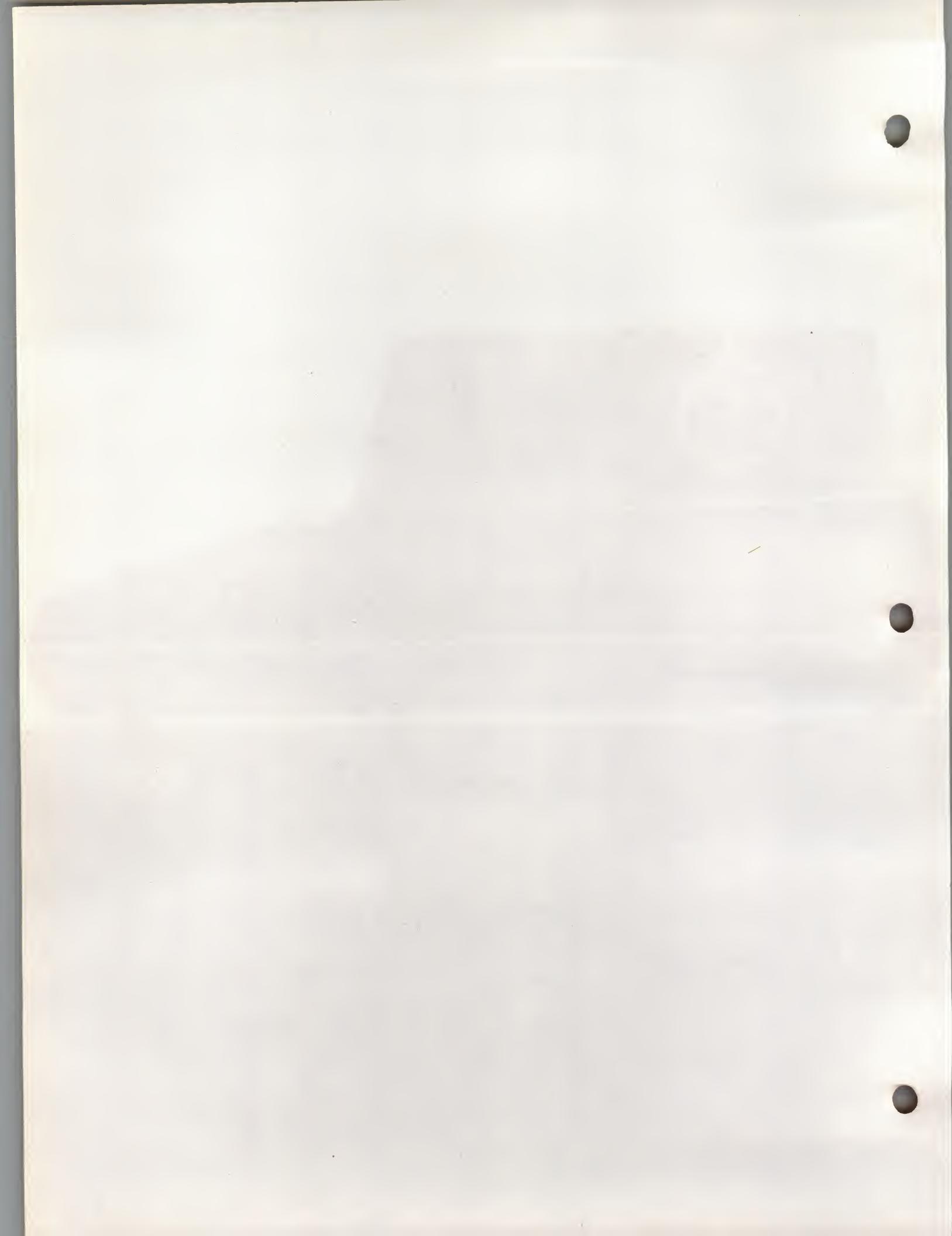
Typical applications for the PDT-11/150 include remote data entry and small business computation. This includes immediate access to locally stored files without host intervention, and data capture and storage for later transmission to the host. Local error checking and order entry preprocessing, inventory control, billing, and scheduling are quickly and simply controlled with any PDT-11/150 series terminal.

There is much more to tell you about these exciting terminal products. If you would like more information on any of these products, call your local DIGITAL sales office or just fill out the attached card.



A red folder or binder cover is shown from a top-down perspective. It features a white horizontal line near the bottom edge and a white circle with a vertical line through it near the top edge, resembling a hole punch or fastener. The folder is bound on the left side. The word "Index" is printed in white capital letters on the right side of the front cover.

Index



INDEX

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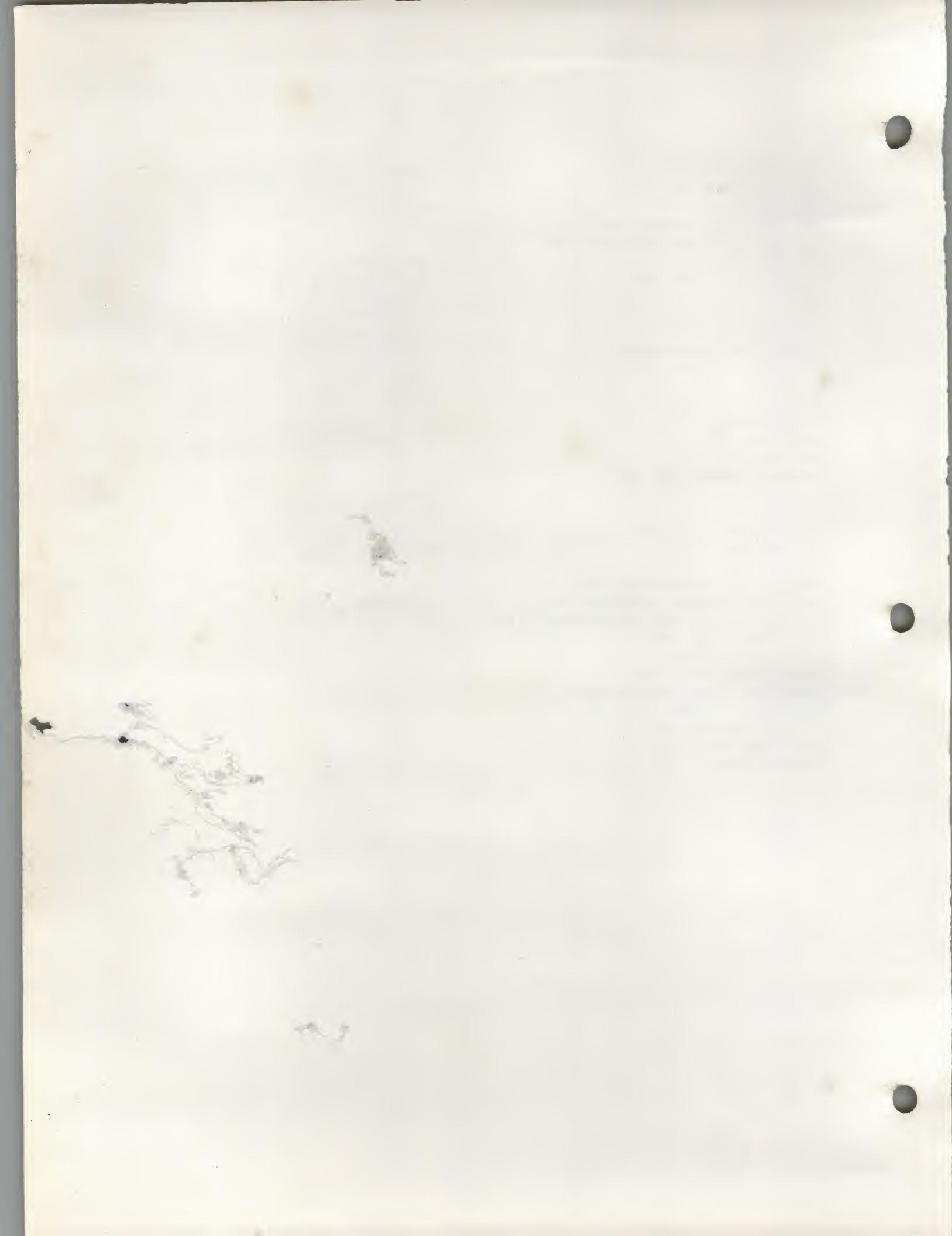
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I'd like to know more about the products checked below

- LA 120 DECwriter III
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- VT100
- PDT Intelligent Terminal Family
- Please keep me on your mailing list for new products

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- On-Site Service
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Number of Terminals at Site _____
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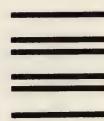
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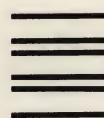
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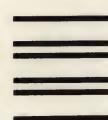
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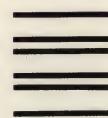
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INSTALLATION, WARRANTY, AND SERVICE INFORMATION

INSTALLATION/WARRANTY

For customers who have purchased directly from DIGITAL, reference the sales agreement for installation and warranty terms purchased with this terminal.

For customers who have purchased, leased, or rented from a vendor other than DIGITAL, contact your vendor for information regarding installation and warranty terms purchased with this terminal.

DIGITAL SERVICES

DIGITAL provides a wide range of maintenance and customer services for your terminal. Using these services, you can design a plan to meet your service needs, from complete DIGITAL maintenance to complete self-maintenance. Vendors supplying DIGITAL products may use these services as factory backup support.

- **On-Site Service**

DIGITAL offers responsive, low cost, factory-level maintenance performed at your site by trained Terminals Service Specialists. This maintenance is provided through service agreements or per-call service.

- Service Agreements cover all your maintenance needs, including priority response; labor, materials, and travel for a fixed monthly charge.
- Per-call service is provided on a "time" and "materials" basis and can serve as a backup to your own in-house maintenance programs.

- **Off-Site Service**

For customers who have troubleshooting expertise, but need assistance for the component repair, DIGITAL has a worldwide network of Product Repair Centers (PRCs) and the Customer Returns Area (CRA). Through a wide array of service product offerings this logistics network offers cost effective services that include the following features.

- Module Mailer™
- Fixed Price Exchange
- Product Refurbishment

- **Spare Parts**

In further effort to assist customers who choose to perform their own computer maintenance, DIGITAL's Customer Spares organization provides thorough and timely spares support through the following features.

- Spares Inventory Planning
- Component/Subassembly Spares
- Maintenance Test Equipment
- Maintenance Documentation Service
- Emergency Spare Parts

- **Training**

DIGITAL's Education Services group offers hardware maintenance courses at any of our 17 worldwide training centers; or, depending on your specific training requirements, courses can be provided in your own facilities.

ORDERING SUPPLIES AND ACCESSORIES

Purchase orders for supplies and accessories should be forwarded to:

Digital Equipment Corporation
Supplies and Accessories
Cotton Road
Nashua, New Hampshire 03060

Contact your local sales office or call DIGITAL Direct Catalog Sales toll-free (800-258-1710) from 8:30 a.m. to 5:00 p.m. eastern standard time (U.S. Customers only). New Hampshire, Alaska and Hawaii customers should dial (603) 884-6660. Terms and conditions include net 30 days and F.O.B. DIGITAL plant. Freight charges will be prepaid by DIGITAL and added to the invoice. Minimum order is \$35.00. Minimum does not apply when full payment is submitted with an order. Checks and money orders should be made out to Digital Equipment Corporation.

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